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A TAXONOMIC REVISION OF CENTROLEPIS (CENTROLEPIDACEAE) IN AUSTRALIA

D. A. Cooke

Animal and Plant Control Commission of South Australia
GPO Box 1671, Adelaide, South Australia 5001

Abstract

Centrolepis in Australia is revised and twenty species are recognised. This revision is based on morphological features that are discussed in relation to the biology of the genus. One new species, *C. curta*, and a new subspecies, *C. strigosa* subsp. *rupestris*, are described and illustrated. The new combinations *C. monogyna* subsp. *paludicola* and *C. strigosa* subsp. *pulvinata* are made.

Introduction

Centrolepis is a genus of small annual and perennial monocots. It forms, with *Aphelia* and *Gaimardia*, the minor family Centrolepidaceae. The family has its main centre of diversity in Australia with 29 species; a few occur in New Zealand, south-eastern Asia and South America. The close affinity of the Centrolepidaceae to the Restionaceae, and its remoteness from the two genera segregated by Hamann (1976) as the Hydatellaceae, are widely recognised in contemporary systems of classification (Cronquist, 1981; Dahlgren & Clifford, 1982; Takhtajan, 1980).

Taxonomic history

The genus first became known from material of the near-coastal species sent to Europe by the early botanist-explorers and collectors. In 1770 Banks and Solander on the Endeavour collected specimens of *Centrolepis*, now referred to *C. banksii* and *C. exserta*, that they tentatively labelled as species of *Schoenus* (Cyperaceae). Labillardière (1804) based the new genus Centrolepis, which he placed under Monandria Monogynia in the Linnaean system, on a Tasmanian specimen.

Robert Brown (1810), using Banks' and Solander's material and his own collections from the voyage of the Investigator around Australia in 1801-4, drafted manuscript epithets for a further twelve *Centrolepis* species. However, in the *Prodromus* he divided these between two new genera, *Alepyrum* (three species) and *Devauxia* (nine species, including Labillardière's *C. fascicularis*). Recognising the broad affinities of these genera, he included them in his concept of Restiaceae. Roemer & Schultes (1817) reinstated the name *Centrolepis* for *Devauxia*; Nees (1841, 1846) described three more species from Preiss and Drummond collections.

The first revision of Centrolepidaceae was produced by Hieronymus (1873), who reduced *Alepyrum* and *Devauxia* to synonymy under *Centrolepis*. Hieronymus' generic concept was maintained by Bentham (1878) and is retained in this revision.

Ecology

Centrolepis is widespread in heath, scrub, herbfield, woodland and open forest, but absent from closed forests and other vegetation with a dense shading canopy.

The majority of species are annuals adapted to habitats with seasonal rainfall delimiting the growing season, and growth within this period further limited by the availability of nutrients or water. They may be categorised as stress-tolerant ruderals in the system of Grime (1979), occupying a range of niches from pioneers of such temporary microhabitats as margins of seasonal pools to permanent members of the sparse herb stratum in heath, woodland or mallee communities. Often several species co-exist, together with other stress-tolerant ruderals such as *Aphelia* and *Isolepis*, on otherwise bare ground or in moss beds. Their reduced and condensed structure is associated with the short growing season and limited resources. There is a gradation between relatively ruderal species with high seed production (high values of *r*, the intrinsic rate of increase) and species closer to a stress-tolerator strategy. The latter are characterised by more reduced structure: simpler inflorescences, fewer seeds per plant, and either a scapeless habit or the gracile "shadowless plant" strategy described for a range of other arid zone therophytes by Shreve (1964).

A rough measure of *r* was estimated from the range of available herbarium material as l_n(median number of seeds/pseudanthium X median number of pseudanthia/head X median number of heads/plant). The annual taxa are listed in order of this quantity in Table 1, showing a gradation between species with specialised stress-tolerator niches and ruderals such as *C. banksii* with much higher seed production. Although *r* is a parameter of populations rather than of species, because herbarium sheets of small annuals are effectively population samples these figures indicate the relative values of *r* achieved by populations of these species.

Centrolepis alepyroides	2.4	*C. aristata*	6.3
C. inconspicua	2.4	*C. cephaloformis* subsp. *cephaloformis*	6.3
C. muscoides	4.4	*C. polygyna*	6.6
C. humillima	4.7	*C. strigosa* subsp. *rupestris*	6.8
C. caespitosa	4.7	*C. strigosa* subsp. *pulvinata*	6.9
C. mutica	5.1	*C. curta*	6.9
C. cephaloformis subsp. *murrayi*	5.3	*C. eremica*	7.2
C. glabra	5.6	*C. strigosa* subsp. *strigosa*	7.4
C. drummondiana	6.2	*C. exserta*	8.1
C. pilosa	6.2	*C. banksii*	8.1

Table 1. Annual *Centrolepis* taxa listed by l_n seed number/plant

The annual species appear to form seed banks in a range of soil types; *Centrolepis* seedlings were obtained from soil samples taken from *Eucalyptus camaldulensis* woodland in the You Yangs (Carroll & Ashton, 1965), and *C. strigosa* was the most abundant annual to germinate from samples of heathland sands from Cranbourne, Victoria. These species occur as opportunists in disturbed habitats; *C. strigosa* has been recorded as a plagioseral species in heath mined for sand, *C. cephaloformis* on former gold workings and *C. pilosa* on overburden dumps.

Centrolepis species have occasionally attracted attention as weeds, eg. *C. fascicularis* in Brisbane gardens (Bailey, 1906) and *C. banksii* in ricefields (Cook, 1974). Swarbrick (1984) lists herbicides registered for control of *C. strigosa* in maize and vegetable crops in eastern Australia, indicating its perceived economic importance.

Seedling development

Freshly collected seed of *C. aristata*, *C. cephaloformis*, *C. drummondiana*, *C. pilosa*, *C. polygyna* and *C. strigosa* was sown in pots in late spring 1979. In each species germination occurred 3-5 months later, implying some mechanism of innate dormancy; a second

germination of *C. cephaloformis* from the original sowing was observed in autumn 1981. Seedlings of *C. humillima* and *C. inconspicua* were also seen in herbarium collections.

In all species examined, germination was epigeal of the type A of Dahlgren & Clifford (1982), the testa being raised on the apex of an erect, terete, photosynthetic cotyledon about 3 mm long. The first plumular leaves emerged through an opening in the sheathing base of the cotyledon as illustrated for *C. strigosa* by Hieronymus (1873). Succeeding leaves showed a transition to the mature leaf form and texture of the species.

Perennial growth

Some species in habitats with no seasonal water deficit have a perennial hummock-forming habit. Unlike the perennial restiads, these species lack well-developed rhizomes. Their stems are leafy and consist of much low-density pith and cortex containing scattered vascular bundles, and for this reason were likened to the culms of other monocots by Cutler (1969); they differ from those of annual *Centrolepis* species only in their indeterminate growth.

Plants of *C. cephaloformis* and *C. strigosa*, which require a cold period to initiate flowering, were maintained in the vegetative state for 18 months in a heated glasshouse. They continued to produce apical growth and adventitious roots like the perennial species.

Leaf and bract morphology

I interpret the types of leaf and bract developed in *Centrolepis* as products of a reduction series from a linear phyllome containing three vascular bundles and divided into a sheathing base and a photosynthetic lamina. The leaves of the related genus *Gaimardia* retain this structure (Fig. 1A).

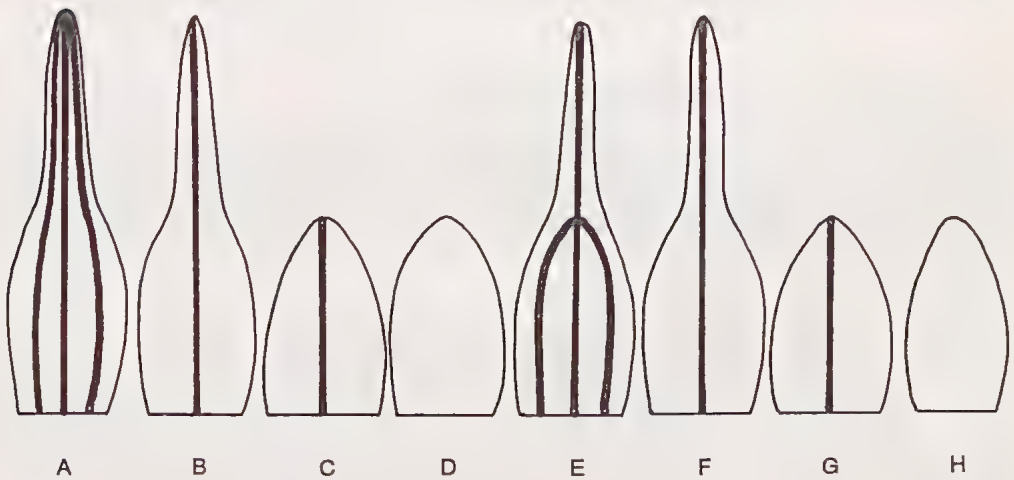


Fig. 1. A, Diagramatic leaf of *Gaimardia*; B, *Centrolepis*; C, cataphyll of *C. humillima*; D, cataphyll of *Centrolepis*; E, primary bract of *C. aristata*; F, primary bract of *C. polygyna*; G, primary bract of *C. monogyna*; H, secondary bract of *C. aristata*.

In all *Centrolepis* species, each leaf has an open scarious sheath containing one central vascular bundle (B). The leaves may have been derived from an original equitant type, and remain manifestly distichous in the relatively primitive species such as *C. aristata*. Similarly distichous and subequitant leaves occur in the primitive restiad *Anarthria* (Johnson & Briggs, 1981), seedlings of some other restiads, and the most primitive species of *Aphelia*. The basically distichous phyllotaxy is obscured in most species by the crowding of leaves from the numerous growing points forming each tuft, sometimes producing a false spiral phyllotaxy in species such as *C. strigosa* with very numerous linear leaves.

The last leaf produced before the inflorescence is further reduced. In *C. aristata* the lamina of this leaf is shortened; in most other species it is completely suppressed, leaving a short scarious sheath that I have termed a cataphyll (Cooke, 1980). This may retain the vascular bundle, as in some specimens of *C. humillima* (C), but more often lacks vascular tissue (D).

The primary bracts are a pair of phyllomes with their sheathing bases modified to enclose the inflorescence, and are comparable in anatomy and vestiture to the leaves in each species. In *C. aristata* (E), the sheath contains three vascular bundles, the lateral pair anastomosing and terminating at the junction of the sheath and lamina (Arber, 1922). Three bundles are also visible in the bract bases of some other species, sometimes with two smaller additional lateral bundles, but in many species only the central bundle is present (F). The primary bracts may bear laminae differing from leaf laminae only in their reduced length. There appears to be a general trend towards the reduction and loss of the lamina from one or both primary bracts (G).

The secondary bracts are defined as those which subtend branches within the inflorescence (Cooke, 1980). They are reduced to hyaline or scarious structures one cell thick, lacking vascular tissue (H) and apparently homologous to the leaf bases, or are absent.

Floral structures

As previously described (Hamann, 1962; Cooke, 1980), the inflorescence is a cymose head enclosed by two primary bracts. These may be separated by a short internode, one or both bracts subtending a cyme; or apparently opposite due to suppression of the internode.

The individual male and female florets are reduced to solitary stamens and carpels showing little gross morphological variation between species. The unit inflorescence is a pseudanthium, interpreted as a condensed monochasium (Cooke, 1980) with a basal stamen and a compound gynoecium of unicarpellate pistils apparently distichous on a false axis or gynophore derived from their successively longer stipes. Each carpel has two vascular bundles, the dorsal bundle running into the style and the ventral bundle supplying the ovule (Prakash, 1969).

The styles with their linear stigmas on the ventral side form a "brush" to intercept windborne pollen; the stigmatic papillae are usually microscopic, but in three species are enlarged and branched, increasing the efficiency of the brush. In *C. pilosa* and *C. polygyna* the first stigmas became functional 1-2 days before the corresponding anther dehisced, therefore the individual pseudanthia may be called proterogynous. However, due to the successive maturation of pseudanthia, heads with several pseudanthia have stigmas and anthers ripe simultaneously; Keighery (1982) found that all species examined were self-fertile. The number of pseudanthia and carpels are important diagnostic characters and reflect the life strategy of the species. In the perennial *K*-strategist or stress-tolerant competitor *C. monogyna* each pseudanthium is reduced to one carpel with an associated stamen.

Fruit and seed

The fruit, a compound structure of scarious follicles, is quite uniform throughout the genus. Each follicle dehisces along a line of weakness adjoining the dorsal vascular bundle.

The testa of the seed is thin and, except in *C. humillima*, without sculpture. Passive dispersal occurs when seeds are shaken from the scapose heads, their small size allowing transport in runoff water or in mud on the feet of birds; or the whole dead plant may function as a disseminule as in *C. cephaloformis* subsp. *cephaloformis*. The suppression of the scape in other species with sessile heads may be an adaptation to atelechory, retaining in a favourable microsite the comparatively few seeds produced.

Vestiture

The hairs and papillae of *Centrolepis* species conform to a narrow range of types, and the branched hairs typical of *Gaimardia* (Cutler, 1969) are never produced. They are all eglandular and developed from a basal epidermal cell which is normally empty, but rarely becomes cystolithic with an accumulation of silica. Cystoliths are occasionally also found in slightly enlarged epidermal cells of glabrous species such as *C. aristata*.

A papilla consists of an outgrowth from the basal cell projecting beyond the plant surface. Hairs consist of a simple chain of up to 8 cylindrical thin-walled cells; those on leaves and bracts are 0.025-0.06 mm wide, usually stiffly perpendicular to the surface and persistent. Hairs on leaf sheaths may be crisped due to the collapse of the cells, and those produced on scapes are lax with very thin cell walls, c. 0.01 mm wide and usually caducous.

In dried material of some glabrous species shrinking of the parenchyma may cause wrinkles in the overlying epidermis. These wrinkles may resemble papillae or appressed microscopic hairs, and were described as such by Cutler (1969) and Curtis (1982).

A major function of the hairs is likely to be reduction of transpiration. The majority of species, except from moist habitats, have leaves which are either hairy (eg. *C. strigosa*) or sclerified (eg. *C. polygyna*).

Chromosome number

Diploid numbers of 20 in *C. strigosa* and 46 or 48 in *C. aristata* (Hamann, 1960) and of 26 in *C. fascicularis* (Briggs, 1966) have been reported. The diploid number of 40 or 42 in *C. cambodiana*, an Asian species related to *C. strigosa* (Larsen, 1963) confirms the presence of at least two levels of ploidy in the genus. A generic base number cannot be deduced with certainty from the range of chromosome numbers in the few species investigated.

CENTROLEPIS Labill.

Centrolepis Labill., Nov. Holl. Pl. Sp. 1:7 (1804); Roemer & Schultes, Syst. Nat. 1:43 (1817); Desv., Ann. Sci. Nat. (Paris) 13:42 (1828); Endl., Gen. Pl. 120 (1836); Kunth, Enum. Pl. 3:489 (1841); Walp., Ann. Bot. 1:896 (1849); Hieron., Abh. Naturf. Ges. Halle 12:209 (1873); F.Muell., Fragm. Phyt. Aust. 8:237 (1874); Benth., Fl. Austral. 7:202 (1878); Benth. & J.D. Hook., Gen. Pl. 3:1026 (1883); Hieron., Pflanzenfam. 2(4):15 (1888); Bailey, Queensl. Fl. 6:1719 (1902); Rodway, Tasm. Fl. 231 (1903); J. Black, Fl. S. Aust. 1:102 (1922); Ewart, Fl. Vict. 260 (1931); Ding Hou, Fl. Males. 5:422 (1957); Hutchinson,

Fam. Fl. Pl. 2:700 (1959); Hamann in Melchior, Syll. Pflanzenfam. 2:559 (1964); Hamann, Bot. Jahrb. Syst. 96:158 (1975).

Type species: C. fascicularis Labill.

Centrosepis R. Hedwig, Gen. Pl. (1806), sphalm. orthog.

Devauxia R. Br., Prodr. 252 (1810); Gaudich., Voy. Uranie. 419 (1829); Nees in Lehm., Pl. Preiss. 2:70 (1846); Steudel, Syn. Pl. Glum. 2:266 (1855).

Type species: D. billardieri R. Br. (Lecto. chosen here being a synonym of the type species of *Centrolepis*, for which *Devauxia* was an avowed substitute, see Brown p. 252).

Brown deliberately spelled this name *Devauxia*, from what he considered the correct Latin form of the French surname Desvaux. In the same way, he formed the generic name *Lechenaultia* (Goodeniaceae) from the surname Leschenault. Although widely emended to *Desvauxia* by subsequent authors, the original spelling is here reinstated as required by the International Code of Botanical Nomenclature, Article 73.

Alepyrum R. Br., Prodr. 253 (1810); Roemer & Schultes, Syst. Nat. 1:44 (1817); Endl., Gen. Pl. 120 (1836); Nees in Lehm., Pl. Preiss. 2:71 (1846); Steudel, Syn. Pl. Glum. 2:266 (1855); J.D. Hook., Fl. Tasman. 2:77 (1858).

Type species: A. polygynum R. Br. (Lecto. chosen here).

Alepyrum Hieron., Abh. Naturf. Ges. Halle 12:217 (1873); Pflanzenfam. 2(4):16 (1888); nom. illeg., non R. Br.

Type species: A. pallidum (J.D. Hook.) J.D. Hook. (The only species retained in this genus by Hieronymus).

Pseudalepyrum Dandy, J. Bot. (Lond.) 70:330 (1932); Hutchinson, Fam. Fl. Pl. 2:700 (1959).

Type species: P. pallidum (J.D. Hook.) Dandy (Lecto. chosen here being a synonym of the type species of *Alepyrum* Hieron., for which *Pseudalepyrum* was an avowed substitute).

Small tufted annual or cushion-forming perennial herbs. *Root system* fibrous with adventitious roots produced from leaf axils. *Main stem* in annual species usually very short and densely branching to form a leafy tuft; in perennials, of indeterminate growth with imbricate leaves. *Leaves* crowded, with dilated membranous open sheathing bases and linear to subulate 1-veined laminae. Uppermost leaf reduced, usually lacking a lamina. *Inflorescence* a terminal cymose head enclosed by 2 primary bracts, often scapose on a single erect internode. Secondary bracts veinless, hyaline or scarious, 2-3 per pseudanthium or absent. *Florets* minute, unisexual, lacking receptacles or perianths, arranged in 1-many sessile pseudanthia comprising 0-1 male and 1-30 female florets. *Male floret* reduced to a solitary stamen; filament usually capillary, glabrous; anther dorsiversatile, unilocular, dehiscing by a longitudinal slit. *Female floret* reduced to a solitary carpel, usually stipitate; ovary ovoid, hyaline, unilocular with 1 pendulous orthotropous ovule. Ovaries within each pseudanthium united, alternating in 2 rows on a false axis (gynophore) incorporating the vascular bundle to each ovary and the lower styles; distal portion of styles free, filiform, exserted, with stigmatic papillae along the adaxial side. *Fruit* compound, dry, membranous, of 1-seeded carpels each dehiscing by an abaxial slit. *Seed* ovoid to fusiform, endospermic with a small apical embryo.

The genus contains 20 species in Australia: 19 are endemic and one extends to New Guinea. The world distribution is centered on Australia; at least one other species occurs in New Guinea and two in south-east Asia extending to Hainan. Three others are endemic to New Zealand.

Key to species of *Centrolepis* in Australia

1. Multicellular hairs present on leaves and/or on primary bracts 2

   Multicellular hairs absent (plants completely glabrous or rarely bearing scattered microscopic papillae)..... 8

2. Perennials; pseudanthia with 1-4 carpels 3
   Annuals; pseudanthia with 4-12 carpels 4
3. Primary bracts pilose or with a few hairs, terminating in subulate laminae subequal to the bract bases ..... 12. *C. fascicularis*
   Primary bracts glabrous and lacking subulate laminae ..... 7. *C. monogyna*
4. Heads ovoid-conic, remaining almost closed; primary bracts glabrous ..... 14. *C. drummondiana*
   Heads cylindric to broadly ovoid, gaping at anthesis; primary bracts strigose 5
5. Heads sessile among the basal leaves ..... 13. *C. curta*
   Heads on leafless scapes 6
6. Primary bracts with arcuate linear laminae subequal to the bract bases ..... 11. *C. pilosa*
   Primary bracts with straight mucros much shorter than the bract bases 7
7. Primary bracts broad-ovate, sheathing at the base, partly concealing the pseudanthia; temperate species flowering in spring ..... 8. *C. strigosa*
   Primary bracts lanceolate, widely diverging and fully exposing the pseudanthia; tropical species flowering in winter ..... 9. *C. exserta*
8. Secondary bracts several to numerous per head, hyaline at anthesis 9
   Secondary bracts absent (one brown, scarious vestigial concealed bract may be present in *C. polygyna*) 14
9. Leaves distichous; heads laterally compressed; primary bract laminae leaf-like 10
   Leaves never distichous; heads terete; primary bract laminae vestigial or absent 12
10. Heads sessile among the basal leaves ..... 3. *C. inconspicua*
    Heads scapose 11
11. Heads more than 1.2 mm wide; scape two-edged for its full length ..... 1. *C. aristata*
    Heads up to 1 mm wide; scape filiform-terete, becoming two-edged just below the head ..... 2. *C. alepyroides*
12. Primary bracts acute; heads ovoid-conic, remaining almost closed ..... 14. *C. drummondiana*
    Primary bracts obtuse; heads broadly ovoid, gaping at anthesis 13
13. Scapes subequal to the leaves; carpels 4-7 per pseudanthium ..... 8. *C. strigosa*
    Scapes exceeding the leaves; carpels 7-20 per pseudanthium ..... 10. *C. banksii*
14. Leaves distichous along elongated stems 15
    Leaves in a basal tuft, stems extremely condensed 16
15. Stigmatic papillae simple, 0.02 - 0.03 mm long ..... 4. *C. muscoides*
    Stigmatic papillae branched, 0.05 - 0.1 mm long ..... 5. *C. pedderensis*
16. Pseudanthia 4-10 per head (rarely 3 in a minority of heads) 17
    Pseudanthia never more than 3 per head 19

17. Margins of the primary bracts regularly ciliolate ..... 15. *C. mutica*

Margins of the primary bracts entire 18

18. Leaf laminae straight, lax; lamina of outer primary bract capillary, shorter than the herbaceous base ..... 6. *C. glabra*

Leaf laminae recurved, rigid; lamina of outer primary bract leaf-like, longer than the brown cartilaginous base ..... 16. *C. eremica*

19. Heads ovoid-conic, at least half as wide as long, sessile; plant lacking dark pigment ..... 19. *C. cephaloformis*

Heads ± cylindric, less than half as wide as long, scapose or sessile; leaves and/or bracts becoming dark-pigmented 20

20. Heads scapose (except in rare depauperate specimens); cataphyll obtuse; stamen adnate to gynophore ..... 17. *C. polygyna*

Heads sessile among basal leaves; cataphyll acute; stamen free from gynophore 21

21. Heads laterally compressed; bract bases dark, indurated ..... 18. *C. humillima*

Heads terete; bract bases scarious-hyaline ..... 20. *C. caespitosa*

1. **Centrolepis aristata** (R. Br.) Roemer & Schultes, Syst. Nat. 1:44 (1817); Kunth, Enum. Pl. 3:490 (1841); J.D. Hook., Fl. Tasman. 2:76 (1858); Hieron., Abh. Naturf. Ges. Halle 12:213 (1873); F. Muell., Fragm. Phyt. Aust. 8:237 (1874); Benth., Fl. Austral. 7:206 (1878); Hieron., Pflanzenfam. 2(4):12 (1888); Bailey, Queensl. Fl. 6:1719 (1902); Rodway, Tasm. Fl. 232 (1903); Diels & Pritzel, Bot. Jahrb. Syst. 35:95 (1904); Ewart, Fl. Vict. 262 (1931); J.H. Willis, Handb. Pl. Vict. 1:278 (1962); Cooke in Jessop & Toelken, Fl. S. Aust. 4:1825 (1986).

Devauxia aristata R. Br., Prodr. 253 (1810), basionym; Nees in Lehm., Pl. Preiss. 2:71 (1846); Steudel, Syn. Pl. Glum. 2:267 (1855).

Type: Princeps Royal Harbour, Oyster Harbour, King Georges Sound [W.A.], xii.1801, *Brown* sub Bennett No.5828 (Lecto. here chosen: BM!; syn: CANB 67860!).

Centrolepis aristata var. *pygmaea* F. Muell ex Benth., Fl. Austral. 7:206 (1878).

Type: Swanport, Tas., *R. Story.* (Holo.: MEL 536053!).

Erect tufted annual 2-20 cm high, rigidly herbaceous, never purplish. *Roots* numerous, sparsely branched. *Stem* short, few-branched from the lower axils forming internodes less than 1 mm long. *Leaves* 3-6, distichous, equitant, near-basal, glabrous; sheath membranous, 3-8 mm long, passing into a keeled triquetrous lamina 10-75 mm long, 0.7-2 mm wide; apex acute, mucronate. Innermost 1 or 2 leaves with laminae reduced in length but never cataphyllous. *Scape* robust, 1-14 cm long, two-edged, glabrous or with scabridulous edges. *Head* laterally compressed, oblong, 1.3-4 mm wide. *Primary bracts* opposite, keeled, 3-veined, glabrous or with scabridulous keels, closely sheathing; outer bract with a brown cartilaginous sheath 3-5 mm long with hyaline margins terminating in minute obtuse lobes, passing abruptly into a lamina 8-45 mm long; inner bract similar but with a lamina 5-30 mm long. *Secondary bracts* 2 per pseudanthium, hyaline, 3-4 mm long, truncate and often erose; additional secondary bracts usually present between the pseudanthia. *Pseudanthia* 3-30, bisexual. *Stamen* free; filament capillary, 5-14 mm long; anther ellipsoid, 1-2 mm long. *Gynoecium* of 3-7 carpels; styles 1.8-3 mm long, connate at the base, pale brown; stigmatic papillae simple, c. 0.02 mm long. *Seed* fusiform, 0.6-0.8 mm long; testa smooth, stramineous. Fig. 2.

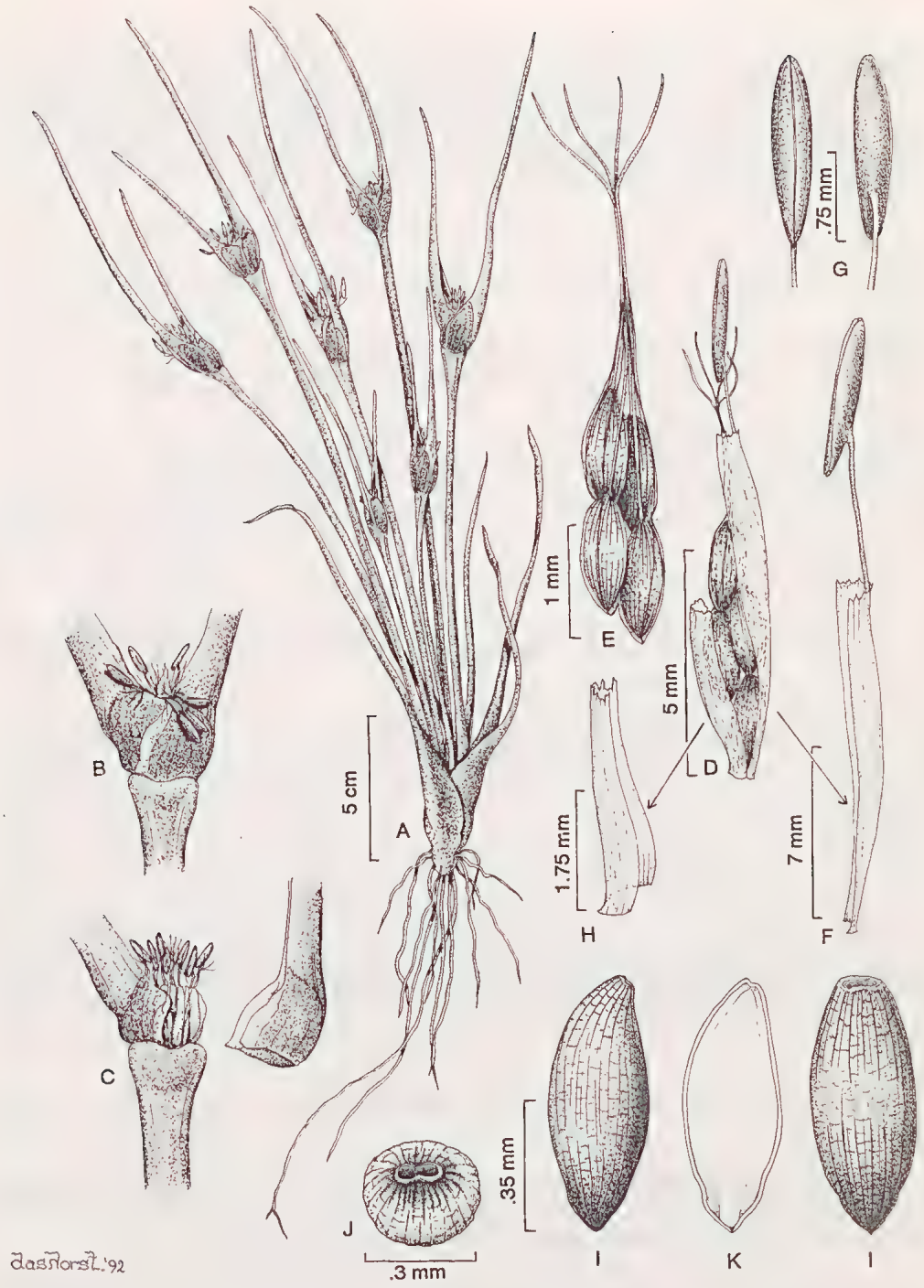
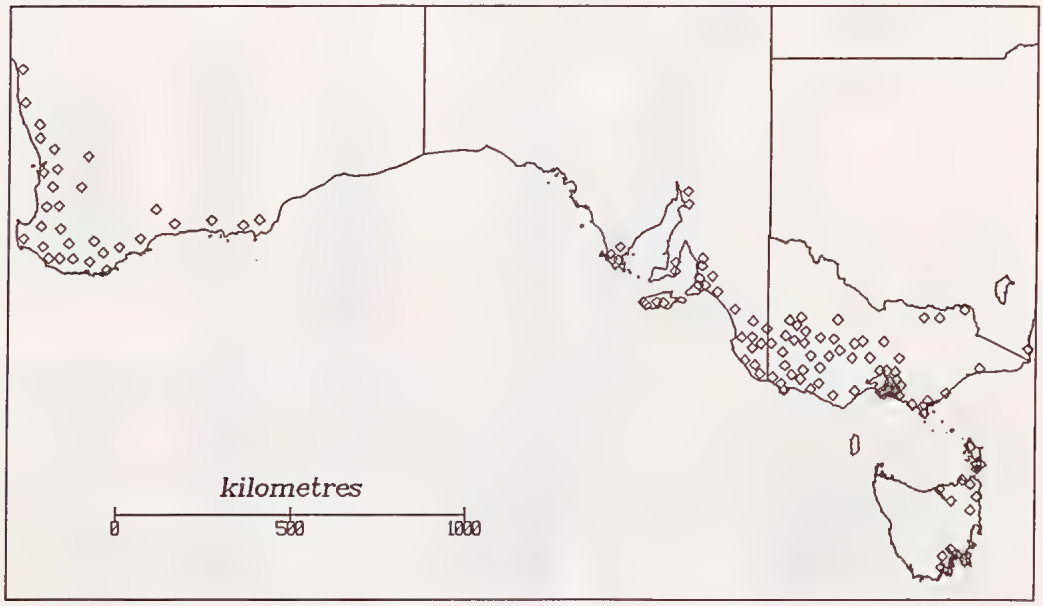


Fig. 2. *Centrolepis aristata.* A, habit; B, head; C, head with outer primary bract detached; D, pseudanthium with secondary bracts; E, gynoecium; F, stamen with secondary bract; G, anther, two views; H, secondary bract; I, seed, two lateral views; J, seed, viewed at micropylar end; K, seed, longitudinal section. (Based on *K. Stove 1834*: AD).

Distribution (Map 1)

Western Australia: widespread in the Avon and Darling botanical districts of Beard (1980) in the south-west. *South Australia*: widespread from southern Eyre Peninsula to the south-east of the State and the southern end of the Flinders Ranges. *New South Wales*: restricted to the extreme South Coast, where known from one record only. *Victoria*: widespread in the Western District and central Victoria south of the Dividing Range; scattered on the Gippsland coast. *Tasmania*: scattered in the north and east.



Map 1. Distribution of *Centrolepis aristata.*

Ecology

Winter annual of moist microhabitats within woodland, open forest, heath and mallee mainly on sandy soils, where often growing with other *Centrolepis* species such as *C. strigosa. Flowers* in September to November.

Notes

The BM sheet includes most of Brown's material with his annotations, and is here chosen as the lectotype.

The variety *pygmaea* was based on depauperate material that also appears to be immature, and is atypical only in its very short scapes. As a complete gradation exists between these specimens and those with normal scapes, I have not recognised the variety.

In the eastern States *C. aristata* never exceeds 10 cm tall, but specimens from Western Australia may reach 20 cm. Mueller applied the manuscript name var. *elata* to some of the latter specimens eg. Harvey River, *A. Oldfield* (MEL).

Selected specimens examined (total 215)

WESTERN AUSTRALIA: Mt Burdett, 4.x.1968, *Eichler 20134* (AD; PERTH); near Howick Hill, 18.ix.1962, *Eichler 19836* (AD); Pallarup Rocks, 13.x.1960, *George 1566* (PERTH); Yanchep National Park, 19.x.1965, *Scrymgeour 105* (PERTH); Helena Valley, 18.ix.1977, *Seabrook 226* (PERTH).

SOUTH AUSTRALIA: Manning Reserve, 17.x.1984, *Cooke 493* (AD); Comaum, 28.x.1962, *Hunt 1310* (AD); Marble Range, 4.x.1979, *Jackson 3682* (AD); Vivonne Bay, 22.x.1968, *Wheeler 1329* (AD); 5 miles E of Wanilla, 11.x.1958, *Whibley 345* (AD).

NEW SOUTH WALES: Eden, 24.x.1936, *Ising s.n.* (AD 966100764).

VICTORIA: Gorae West, xii.1943, *Beauglehole 254* (MEL); Arthurs Seat, 6.xii.1952, *Melville 2243* (MEL); Cosstick Reserve, 15.x.1960, *Muir 1471* (MEL); Chapple Vale, xi.1960, *Muir 1814* (MEL); Mount Morton, 26.x.1952, *Packe s.n.* (MELU).

TASMANIA: Piper Heads, 22.x.1960, *Burns 396* (HO); 7 km NW Gladstone, 24.xi.1974, *Chinnock 2215* (AD); Pittwater Causeway, 10.x.1966, *J.H. Hemsley 6018* (HO); Cape Barren Island, 20.xi.1969, *Whinray 424* (HO); Clarke Island, 16.xi.1979, *Whinray 1628* (AD).

2. **Centrolepis alepyroides** (Nees) Walp., Ann. Bot. 1:897 (1849); Hieron, Abh. Naturf. Ges. Halle 12:210 (1873); F. Muell. Fragm. Phyt. Aust. 8:237 (1874); Benth., Fl. Austral. 7:204 (1878); Blackall & Grieve, West. Aust. Wildfl. 1:59 (1954); Rye in Marchant et al., Fl. Perth Reg. 2:925 (1987).

Devauxia alepyroides Nees in Lehm., Pl. Preiss. 2:71 (1846), basionym; Steudel, Syn. Pl. Glum. 2:267 (1855).

Type: in arenosis aquaticis planitei ad radices jugi montani Darlings Range, Perth [W.A.], x.1839, *L. Preiss 1739* (Holo.: B, n.v.; iso.: MEL 536052!, MEL 1510141!). The holotype is annotated "Hb Nees".

Slender erect annual 1.5-6 cm high, softly herbaceous, becoming purplish after flowering. *Roots* few, the primary root persistent, unbranched. *Stem* usually unbranched. *Leaves* 2-4, near basal, distichous, glabrous; sheath membranous, 2-6 mm long, passing into a subterete keeled lamina 4-12 mm long, c. 0.4 mm wide; apex obtuse, often with a minute recurved mucro. Cataphyll absent. *Scape* filiform, 1-5 cm long, terete below, becoming two-edged just below the head, glabrous. *Head* laterally compressed, oblong, 0.6-1 mm wide. *Primary bracts* opposite, keeled, 3-veined, glabrous, closely sheathing; outer bract with a sheath 2.6-3.8 mm long, membranous with hyaline margins terminating in minute obtuse lobes, passing abruptly into a lamina 3.6-10 mm long; inner bract similar but with a lamina 1-4 mm long. *Secondary bracts* 2 per pseudanthium, acute, entire, hyaline. *Pseudanthia* 2-5, bisexual. *Stamen* free; filament capillary, 2.8-3.7 mm long; anther ellipsoid, c. 1 mm long. *Gynoecium* of 1-3 carpels; styles c. 2 mm long, connate for about half their length, dull pink; stigmatic papillae simple, c. 0.02 mm long. *Seed* fusiform, 0.6-0.7 mm long; testa smooth, stramineous. Fig. 3.

Distribution (Map 2)

Western Australia: scattered in the Avon and Darling botanical districts of the south-west.

A record for New South Wales (Bentham, 1878) was based on a misdetermination of a specimen of *C. polygyna* (Beckler, Hastings R.) now in MEL.

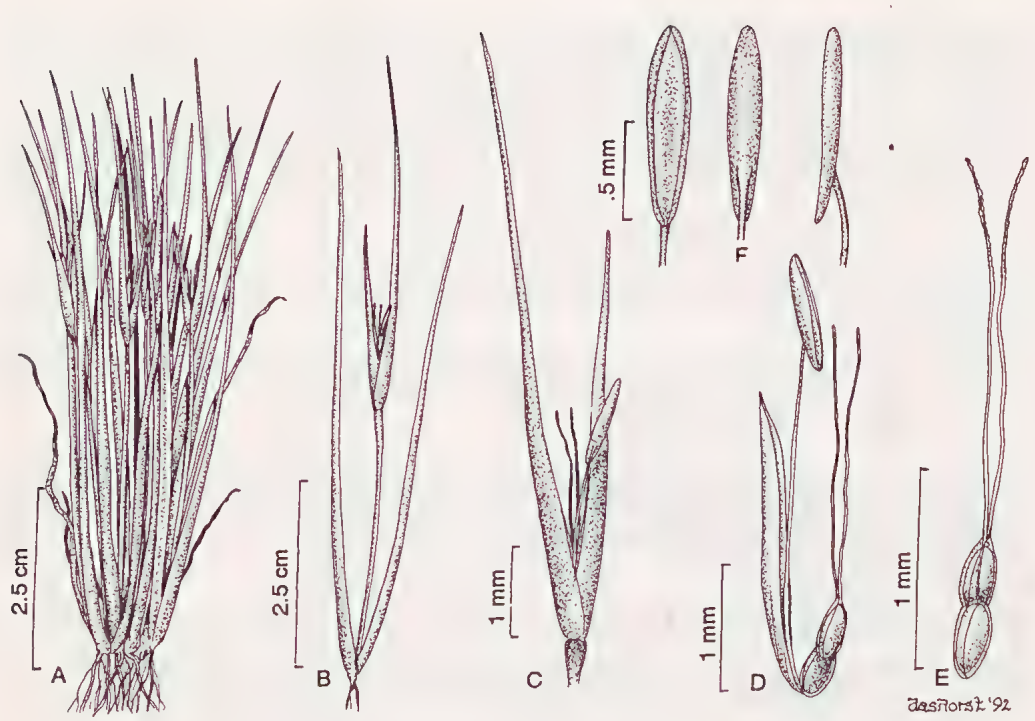


Fig. 3. *Centrolepis alepyroides*. A, habit; B, single plant; C, head; D, pseudanthium; E, gynoecium; F, anther, three views. (Based on *R.D. Spencer s.n.*: MEL 537442).

Ecology

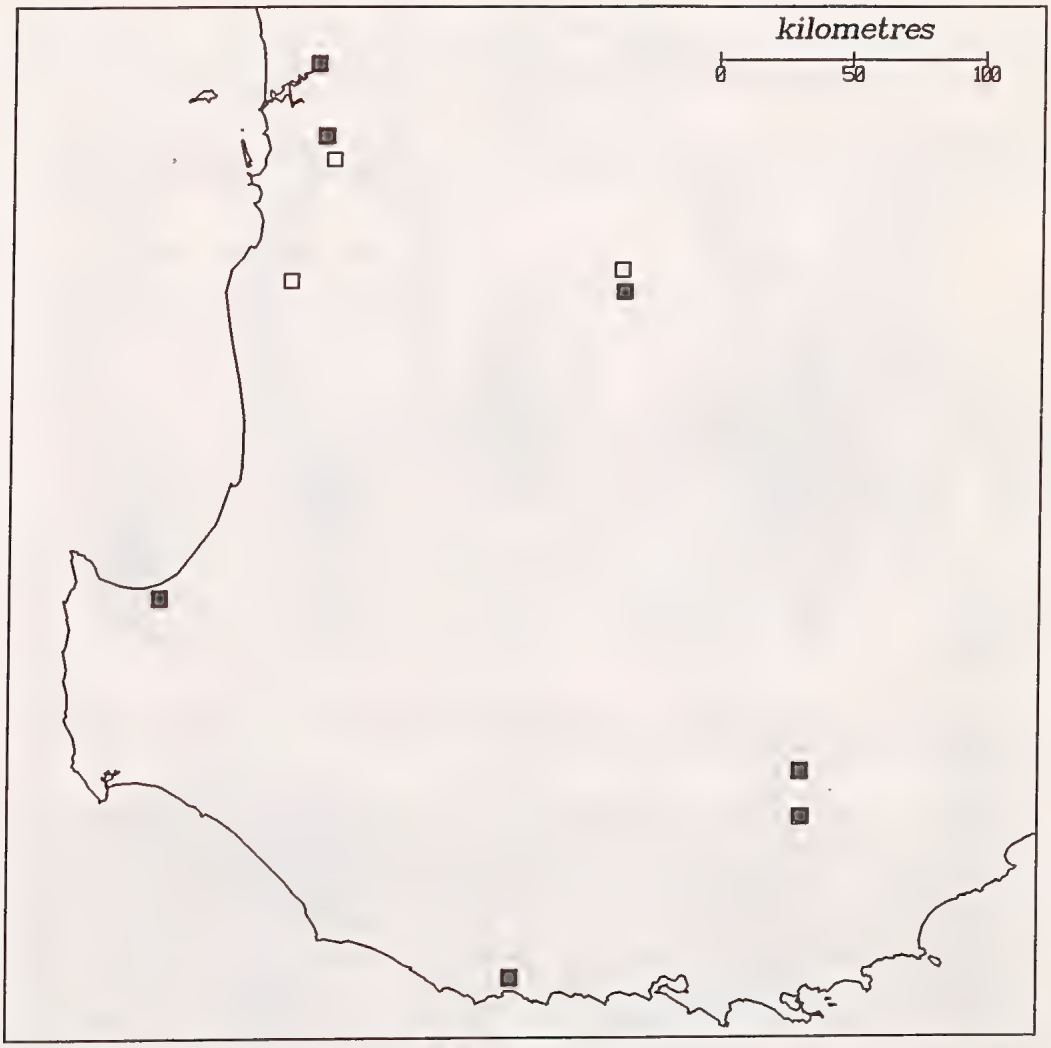
Short-lived winter annual restricted to moist habitats including moss beds and sandy margins of wetlands. *Flowers* in September to October.

Notes

C. alepyroides appears to be much rarer than *C. aristata* within the common range of these species. However, the low number of collections may also reflect the short life cycle implied by its small size, unbranched stem and persistent primary root. It is closely related to *C. aristata* but with a more gracile habit and reduced numbers of pseudanthia and carpels, suggesting a niche further from the ruderal strategy. In material examined, fewer than 15 seeds were produced per plant, implying a value of *r* remarkably low among annuals.

Specimens examined

WESTERN AUSTRALIA: north of Stirlings Range, x.1867, *Mueller s.n.* (MEL); Stirlings Range, x.1867, *Mueller s.n.* (MEL); Ambergate, 19.x.1948, *Royce 2900* (PERTH); Tutanning Reserve, 19.ix.1962, *Royce 7615* (PERTH); Guildford, 1894, *Sewell s.n.* (MEL); Walpole National Park, 7.x.1978, *Spencer 4* (MEL).



Map 2. Distribution of *Centrolepis alepyroides* ■ and *C. inconspicua* □.

3. **Centrolepis inconspicua** W.V. Fitzgerald, Proc. Linn. Soc. N.S.W. 28:107 (1903); Cooke, Muelleria 4:267 (1980); Rye in Marchant et al., Fl. Perth Reg. 2:927 (1987).

Type: Pinjarrah [W.A.], in wet spots, x.1900, *W. Fitzgerald s.n.* (Holo.: NSW 60350!).

Centrolepis basiflora C.H. Ostenfeld, Biol. Meddel. Kongel. Danske Vidensk. Selsk. 3(2):13 (1921).

Type: Armadale prope Perth [W.A.], 20.ix.1914, *Ostenfeld 11* (Holo.: C!; iso.:MEL 535280!; DBN, n.v.).

Minute tufted annual 0.5-2 cm high, rigidly herbaceous, never purplish. *Roots* few, the primary root persistent, sparsely branched. *Stem* unbranched; internodes of negligible length. *Leaves* 2-5, basal, distichous, equitant, erect, glabrous; sheath scarious, 3-4 mm long, passing into a keeled linear lamina 4-30 mm long, 0.5-1 mm wide; apex obtuse or produced into a hyaline mucro. Cataphyll absent. *Scape* absent. *Head* sessile, laterally

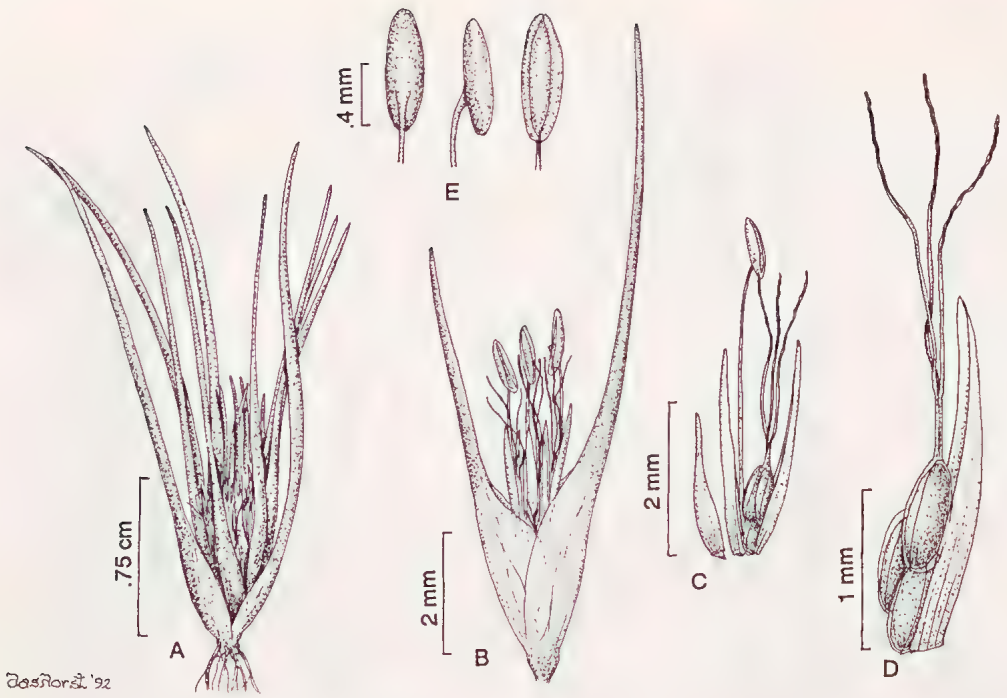


Fig. 4. *Centrolepis inconspicua.* A, habit; B, head; C, pseudanthium; D, gynoecium with second bract; E, anther, three views. (Based on *F. Mueller s.n.*: MEL 1502031).

compressed, oblong, 1-2 mm wide; rarely 1-3 additional heads sessile in the upper leaf axils. *Primary bracts* opposite, 3-veined, glabrous or the keels scabridulous with a row of antrorse papillae, gaping at anthesis; outer bract with a brown scarious sheath 1.5-3 mm long with hyaline margins ending in minute lobes, abruptly passing into a leaf-like lamina 4.5-13 mm long; inner bract similar with a lamina 3-10 mm long. *Secondary bracts* 2 per pseudanthium, hyaline, 2-3 mm long, acute and entire or minutely erose; additional shorter secondary bracts often present between the pseudanthia. *Pseudanthia* 2-5, bisexual. *Stamen* free; filament capillary, 2-4 mm long; anther ellipsoid, c. 0.8 mm long. *Gynoecium* of 1-4 carpels; styles c. 2 mm long, very shortly connate, pale brown; stigmatic papillae simple, c. 0.02 mm long. *Seed* fusiform, c. 0.5 mm long; testa smooth, stramineous. Fig. 4.

Distribution (Map 2)

Western Australia: scattered in the Avon and Darling botanical districts of the south-west between the 500 and 900 mm annual isohyets. Recorded from three localities only, but possibly more widespread and overlooked due to its size.

Ecology

Winter annual restricted to seasonally moist habitats including moss beds and sandy margins of wetlands. *Flowers* in September to October.

Specimens examined

WESTERN AUSTRALIA: Pinjarrah, x.1900, *W. Fitzgerald s.n.* (NSW); Armadale, 20.ix.1914, *Ostenfeld 11* (C; MEL); Tutanning Reserve, 18.x.1962, *Royce 7541* (PERTH); W.A., n.d., *n.coll.* (MEL 1502031).

4. **Centrolepis muscoides** (J.D. Hook.) Hieron., Abh. Naturf. Ges. Halle 12:209 (1873); Benth, Fl. Aust. 7:205 (1878); Rodway, Tasm. Fl. 231 (1903); W.M. Curtis, End. Fl. Tasm. 6:436 (1978).

Alepyrum muscoides J.D. Hook., Fl. Tasman. 2:77 (1858).

Type: Marlborough [Tas.], *R.C. Gunn s.n.* (Holo.: K; photo.!).

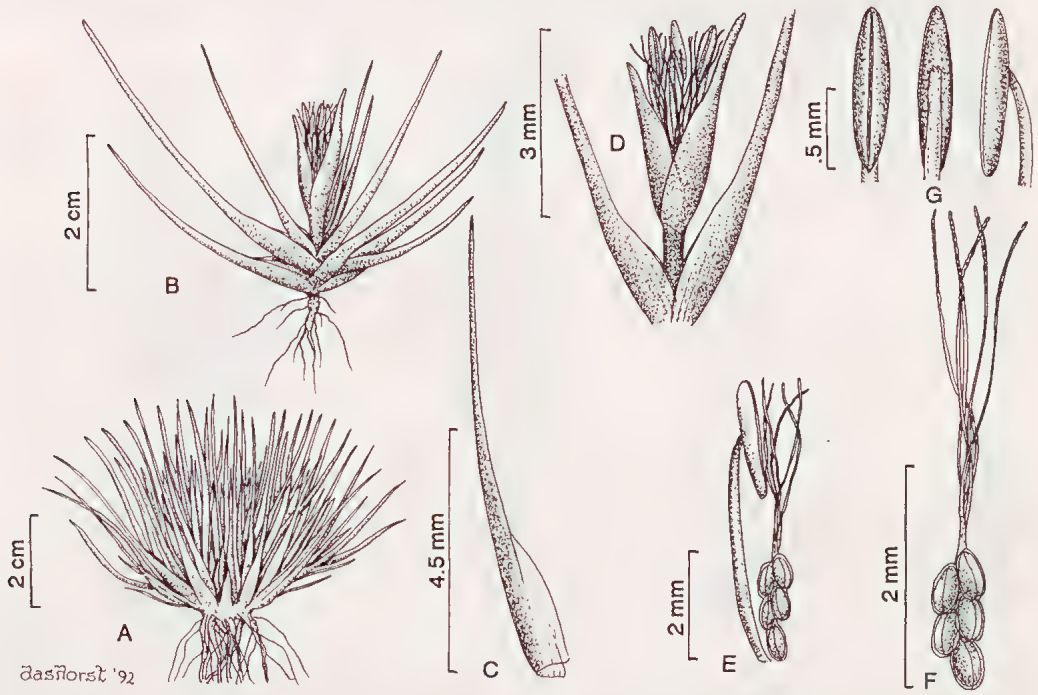


Fig. 5. *Centrolepis muscoides.* A, habit; B, branch; C, leaf; D, head with leaves; E, pseudanthium; F, gynoecium; G, anther, three views. (Based on *M.G. Noble 29074*: HO).

Loosely tufted annual 1-4 cm high, softly herbaceous, often becoming purplish. *Roots* adventitious, solitary at each node and emerging perpendicular to the leaf plane, usually unbranched, 2-5 cm long, robust. *Stem* erect, to 3 cm long, simple or sparsely branched. *Leaves* numerous, equitant, distichous, suberect in a fan-shaped cluster, glabrous; sheath 2-6 mm long, membranous with imbricate hyaline margins, passing abruptly into a subterete keeled lamina 2-9 mm long, 0.2-0.4 mm wide; apex subacute with a terminal hydathode. Uppermost 1 or 2 leaves reduced, cataphyll-like with lamina 1-2 mm long. *Scape* terete at the base, flattened distally, 1-2.5 cm long, glabrous. Heads terete, cylindric, c. 1 mm wide, gaping. *Primary bracts* opposite, rounded on the back, sheathing, 1-veined, glabrous; outer bract with a sheath 3-4 mm long with broad scarious margins, abruptly contracted into a subulate lamina c. 0.5 mm long; inner bract 2.7-3.7 mm long. *Secondary bracts* absent. *Pseudanthia* 2-5, 1-2 bisexual, the others lacking the stamen. *Stamen* free; filament 4-5 mm

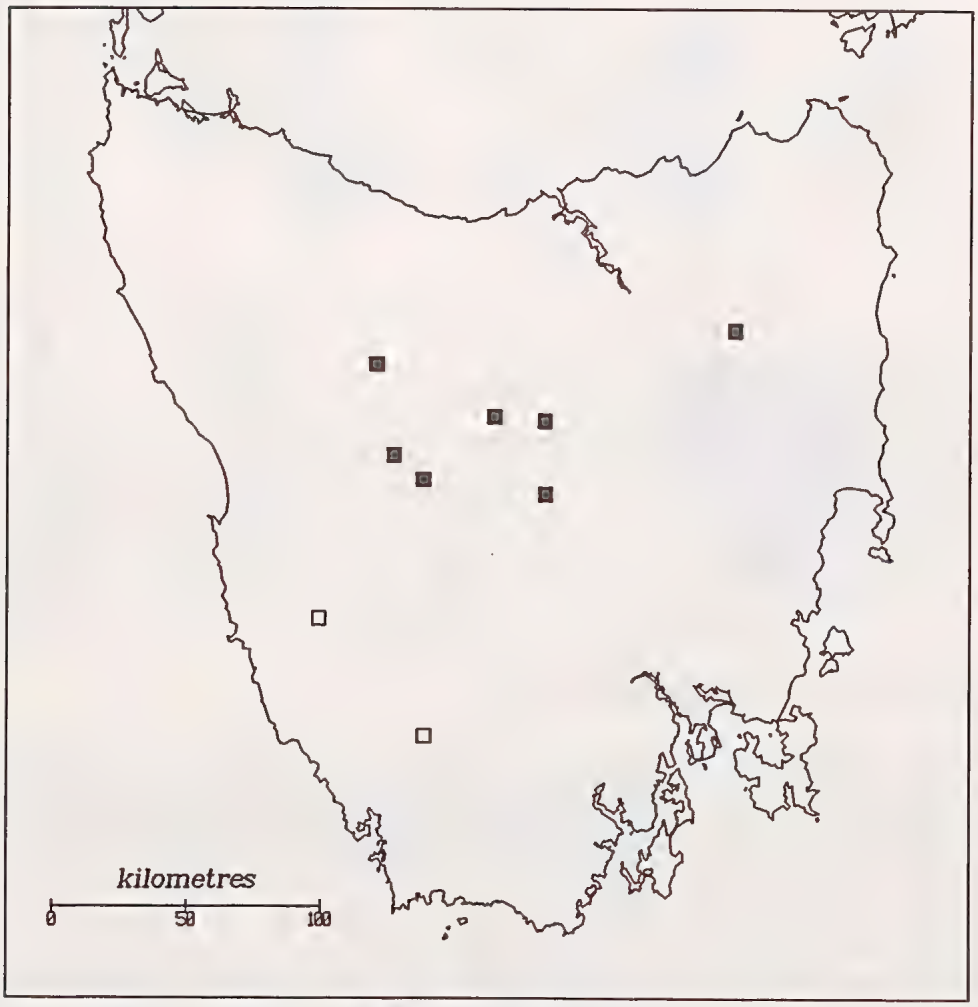
long, thickened below, reddish-mottled; anther ellipsoid, c. 1 mm long, purplish. *Gynoecium* of 5-8 carpels; styles 2-3 mm long, connate at the base only, deep pink; stigmatic papillae simple, 0.02-0.03 mm long. *Seed* fusiform, c.0.5 mm long; testa smooth, stramineous. Fig. 5.

Distribution (Map 3)

Tasmania: endemic to the Central Plateau and Ben Lomond, always above 600 m altitude.

Ecology

Summer annual, persisting as a perennial where covered by water during the winter, around the margins of lakes and streams on sandy alluvium with mosses. *Flowers* in January to April.



Map 3. Distribution of *Centrolepis muscoides* ■ and *C. pedderensis* □.

Specimens examined

TASMANIA: no locality, no date, *Archer s.n.* (HO 23852); Dove Lake, Cradle Mountain Reserve, 4.ii.1961, *Burns s.n.* (HO); Lake Augusta, 4.iv.1971, *Curtis s.n.* (HO); Lake St.Clair, 1976, *Dobson s.n.* (HO); Lake Augusta, iii.1971, *Edwards s.n.* (HO); Lake Augusta, 4.iv.1971, *Edwards s.n.* (HO); Menamatta Tarns, 22.ii.1980, *M. Noble* 29074 (HO, MEL); Great Lake, ii.1894, *Rodway s.n.* (HO); Lake Marion, 15.i.1974, *Williams s.n.* (HO).

5. **Centrolepis pedderensis** W.M. Curtis, Brunonia 7:299 (1985).

Type: Tasmania, sandy shore of Lake Pedder (before flooding), 14.iii.1971, *P. Tyler s.n.* (Holo.: HO 49886!).

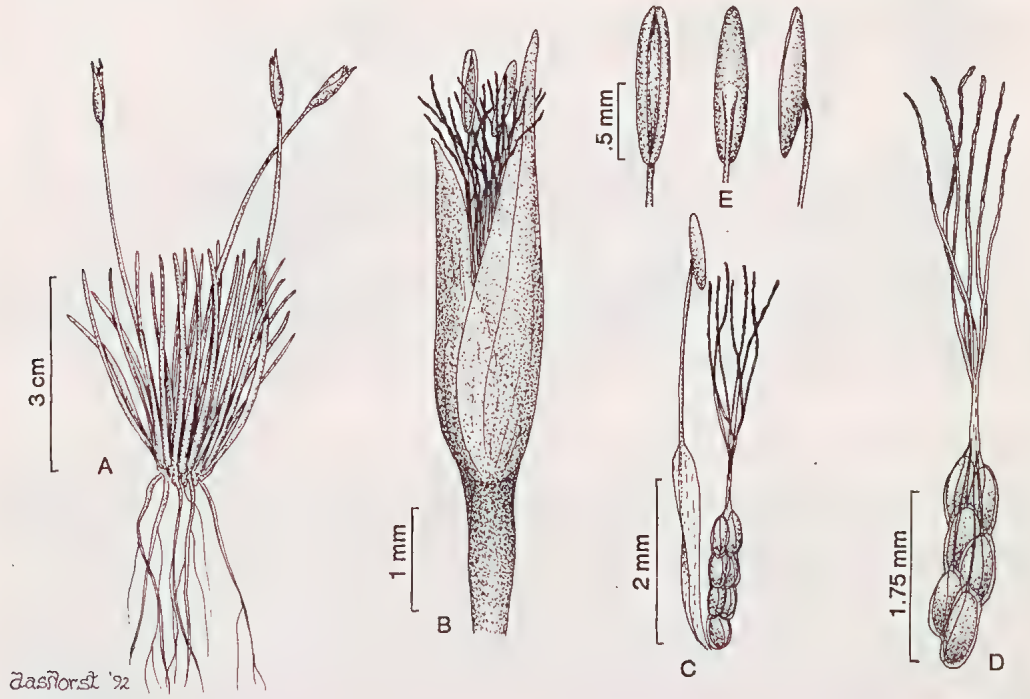


Fig. 6. *Centrolepis pedderensis*. A, habit; B, head; C, pseudanthium; D, gynoecium; E, anther, three views. (Based on *P.A. Tyler s.n.*: HO 49886).

Tufted annual or perennial 3-5 cm high, softly herbaceous, forming clumps to 7 cm diameter. *Roots* adventitious, solitary at each node and emerging perpendicular to the leaf plane, usually unbranched, 2-5 cm long, robust. *Stem* erect, to 4 cm long, simple or sparsely branched. *Leaves* numerous, equitant, distichous, suberect in a fan-shaped cluster, glabrous; sheath 3-10 mm long, membranous with imbricate hyaline margins, passing abruptly into a subterete keeled lamina 3-20 mm long, 0.3-0.8 mm wide; apex subacute with a terminal hydathode. Uppermost 1 or 2 leaves reduced, cataphyll-like with laminae 1-2 mm long. *Scape* terete at the base, flattened distally, 2-3.5 cm long, glabrous. *Head* terete, cylindric, c. 1 mm wide, gaping. *Primary bracts* opposite, rounded on the back, sheathing, 1-veined, glabrous; outer bract with a herbaceous sheath 3.5-4.5 mm long with broad scarious margins, abruptly contracted into a subulate lamina 0.5-1.2 mm long; inner bract elliptic, acute, 3.3-4.2 mm long, lacking a lamina. *Secondary bracts* absent. *Pseudanthia* 2-6, 1-2 bisexual, the others lacking the stamen. *Stamen* free; filament 4-5 mm long, thickened and compressed below, filiform near the apex, reddish; anther ellipsoid, 1-1.5 mm long,

purplish. *Gynoecium* of 3-7 carpels; styles 2.5-3.5 mm long, connate at the base only, deep pink; stigmatic papillae mostly trilobed, 0.05-0.1 mm long. *Seed* fusiform, c.0.5 mm long; testa smooth, stramineous. Fig. 6.

Distribution (Map 3)

Tasmania: along the Gordon River system and Lake Pedder, up to 300 m altitude.

Ecology

Summer-growing perennial, or a facultative annual in less favourable sites, on the sandy alluvium of streams and lake shores. *Flowers* in November to March.

Notes

A sibling species to *C. muscoides*, the range of these two species coinciding with two of the distinct centres of local endemism recognised by Kirkpatrick & Brown (1984).

C. pedderensis was a characteristic species of the quartz sand shore of the original Lake Pedder, where it formed large hummock-like clumps illustrated by Bayly et al. (1972) as *Centrolepis* sp. Although this habitat was destroyed in 1973, *C. pedderensis* persists along the Gordon River and may occur elsewhere in south-western Tasmania.

Specimens examined

TASMANIA: Gordon River Splits, 14.x.1977, *Crowden & Jarman s.n.* (HO); Lake Pedder, 24.i.1953, *Cruikshank s.n.* (HO); Lake Pedder, 25.i.1953, *Cruikshank s.n.* (MEL); Lake Pedder, 27.ii.1971, *Roper s.n.* (MEL); Lake Pedder, iii.1971, *Roper s.n.* (HO; MEL); Lake Pedder, 4.iii.1966, *Tyler s.n.* (HO; MEL); shore of Lake Pedder, 14.iii.1971, *P. Tyler s.n.* (HO).

6. **Centrolepis glabra** (F. Muell. ex Sonder) Hieron., Abh. Naturf. Ges. Halle 12:209 (1873); F. Muell., Fragm. Phyt. Aust. 8:237 (1874); Benth., Fl. Austral. 7:204 (1878); Tate, Handb. Fl. Extratrop. S. Aust. 178 (1890); Rodway, Tasm. Fl. 231 (1903); J. Black, Fl. S. Aust. 1:102 (1922); Ewart, Fl. Vict. 261 (1931); J.H.Willis, Handb. Pl. Vict. 1:279 (1962); Cooke in Jessop & Toelken, Fl. S. Aust. 4:1827 (1986); Rye in Marchant et al., Fl. Perth Reg. 2:926 (1987).

Devauxia glabra F. Muell. ex Sonder, Linnaea 28:226 (1856), ut 'Desvauxia', basionym.

Type: Mount Emu Creek [Vic.], *Mueller s.n.* (Holo.: MEL 536058!). Locality erroneously transcribed as "Mount Gumcreek" by Sonder.

Alepyrum muelleri J.D. Hook., Fl. Tasman. 2:78 (1858).

Type: Macquarie River [Tas.], *ex herb. R.C. Gunn s.n.* (Holo.: K photo.!).

Centrolepis platychlamys F.M. Reader, Victorian Nat. 23:23 (1906).

Type: Little Desert, Lowan [Vic.], xi.1900, *F. Reader s.n.* (Holo.: MEL!).

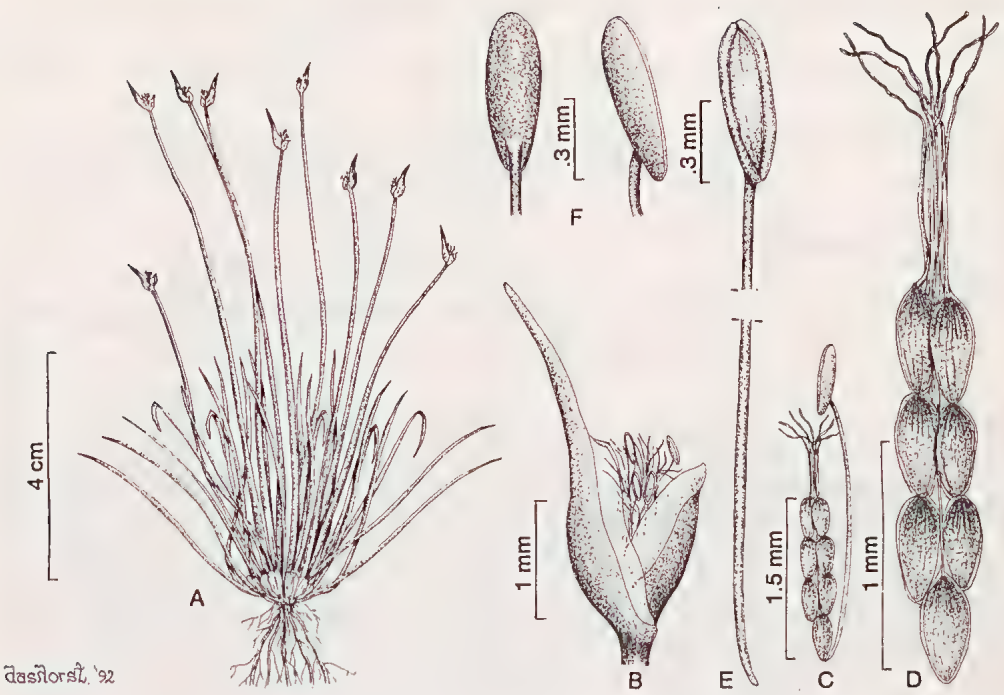
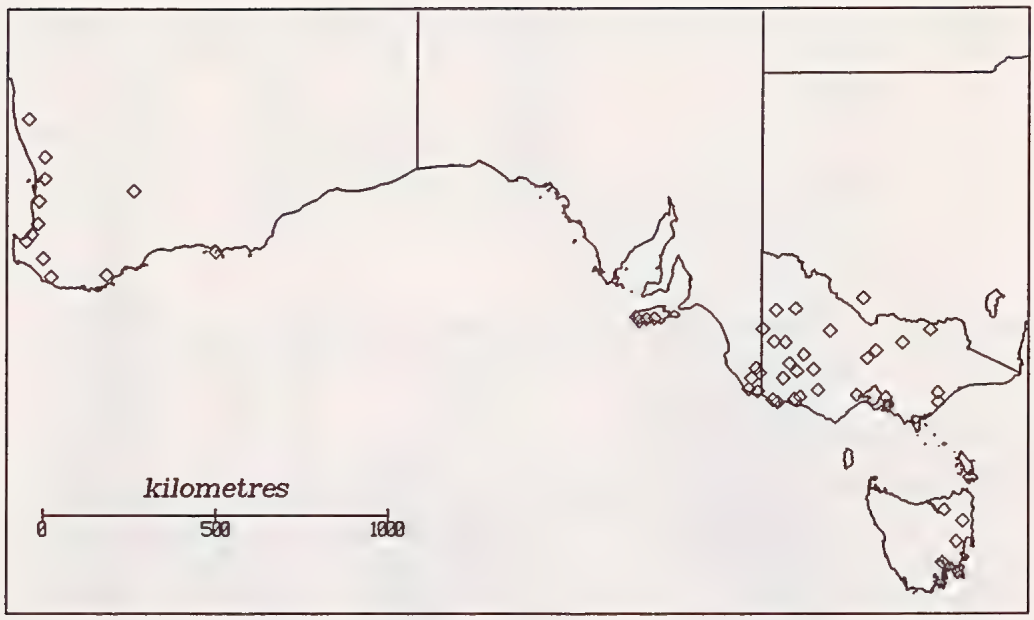


Fig. 7. *Centrolepis glabra.* A, habit; B, head; C, pseudanthium; D, gynoecium; E, stamen; F, anther, two views. (Based on *Hunt 2240*: AD).

Annual or ephemeral 1-8 cm high, softly herbaceous, sometimes becoming purplish. *Roots* numerous, sparsely branched. *Stem* few-branched; internodes of negligible length. *Leaves* few, basal, lax, glabrous; sheath 2-5 mm long, membranous with hyaline margins, passing into a flat linear straight lamina 8-75 mm long, 0.2-0.3 mm wide; apex acute, mucronate. Uppermost leaf reduced to an acute veinless hyaline cataphyll. *Scape* filiform, terete, 10-45 mm long, glabrous. *Head* terete, ovoid to cylindric, c. 1 mm wide. *Primary bracts* opposite, rounded on the back, closely sheathing, 1-veined, glabrous; outer bract with a herbaceous sheath 1.5-4 mm long with entire hyaline margins, abruptly contracted into a straight capillary lamina 0.8-2.5 mm long; inner bract 1.4-2.8 mm long, herbaceous with hyaline margins, acute, lacking a lamina or rarely mucronulate. *Secondary bracts* absent. *Pseudanthia* 3-7, bisexual or 1-2 lacking the stamen. *Stamen* free; filament capillary, 2-4 mm long; anther ovoid, 0.5-0.6 mm long. *Gynoecium* of 4-7 carpels; styles c. 1.5 mm long, connate at the base or rarely for up to 0.5 mm, pink to red; stigmatic papillae simple, c. 0.03 mm long. *Seed* ovoid, c. 0.4 mm long; testa smooth, stramineous. Fig. 7.

Distribution (Map 4)

Western Australia: scattered in the Avon and Darling botanical districts of the south-west. *South Australia*: restricted to Kangaroo Island and the lower South-East. *New South Wales*: restricted to the southern Riverina, where rare. *Victoria*: widespread in the Western District to about 36°N, extending to the Murray Valley; uncommon and localised on the coast. *Tasmania*: widespread at low altitudes.



Map 4. Distribution of *Centrolepis glabra.*

Ecology

A winter-growing annual with a specialised niche on bare mud around temporary water, and lacking the moisture conserving devices (hard texture or hairs) found in other annual species. It occurs on margins of streams and pools, sometimes associated with *Trithuria submersa* and *Aphelia gracilis* but never with other *Centrolepis* species. *Flowers* in September to December; very rarely found growing and flowering in autumn.

Notes

Plants vary greatly in the length of leaves and scapes, which are longest in specimens growing partly submerged. *C. platychlamys* was described from depauperate material with very short scapes, and was reduced to synonymy by Ewart et al. (1906).

Inflorescence characters are more constant, but some Western Australian material has relatively elongated heads with mucronulate inner primary bracts.

Selected specimens examined (total 78)

WESTERN AUSTRALIA: Midland Junction, 22.xi.1899, *Morrison s.n.* (PERTH); Yoonganillup, 16.x.1950, *Royce 3375* (PERTH); Middle Island, Recherche Archipelago, 22.xi.1950, *Willis s.n.* (MEL); 15 km N of Badgingarra, 2.xi.1965, *P. Wilson 3836* (PERTH); 0.5 km N of Brunswick Junction, 30.ix.1967, *P. Wilson 6254* (PERTH).

SOUTH AUSTRALIA: Comaum, i.1971, *K. Alcock 219* (AD); The Lorimer, Bool Lagoon, 27.xi.1964, *Hunt 2277* (AD); Kelly Hill, Kangaroo Island, 5.xi.1958, *P. Wilson 748* (AD).

NEW SOUTH WALES: Edward River, x.1875, *Mueller s.n.* (MEL).

VICTORIA: Mt Arapiles, 22.xi.1968, *Beauglehole 29750* (MEL); Black Range, 13.xii.1968, *Beauglehole 30062* (MEL); Winton, 14.x.1942, *R. Black s.n.* (MEL); Little Desert, 36°36'S 141°48'E, 4.xi.1978, *Cooke 232* (MEL); Tooley Reserve, 10.x.1982, *Spooner 8472* (AD).

TASMANIA: Epping, 22.xii.1955, *Curtis s.n.* (HO); Allwrights Lagoons, 1.xii.1990, *Moscal 20271* (AD).

7. **Centrolepis monogyna** (J.D. Hook.)Benth., Fl. Austral. 7:205 (1878);Rodway, Tasm. Fl. 232 (1903); W.M. Curtis, End. Fl. Tasm. 4:262 (1973).

Alepyrum monogynum J.D. Hook., Fl. Tasman. 2:77, t.138B (1858), basionym.

Type: [Tasmania], "1434", ex herb. *R.C. Gunn* (Holo.: K, photo.!).

Aphelia monogyna (J.D. Hook.) Hieron., Abh. Naturf. Ges. Halle 12:208 (1873).

Pseudalepyrum monogynum (J.D. Hook.)Dandy, J. Bot. (Lond.) 70:330 (1932).

Cushion-forming perennial 2-5 cm high, rigidly herbaceous, often purplish. *Stems* numerous, suberect, branching, with adventitious roots. *Leaves* numerous, crowded, obscurely distichous; sheaths imbricate, 4-6 mm long, scarious, stramineous to whitish, pilose with 2-many lax hairs, forming a minute ligule at the junction with subulate glabrous laminae 5-12 mm long, 0.2-0.4 mm wide; apex acute to obtuse, emucronate. Uppermost leaf reduced to an acute scarious 1-veined cataphyll c. 6 mm long. *Scape* terete, glabrous, to 1 cm long at anthesis, later accrescent to 1-2.5 cm long. *Head* slightly compressed, c. 2 mm wide. *Primary bracts* separated by an internode 0.7-1.2 mm long, closely sheathing, rounded on the back, herbaceous with subhyaline margins, 1-veined, glabrous, brown-tinted; outer bract with a sheath 3-4 mm long contracted into a foliar point 0.5-1.5 mm long; inner bract slightly shorter, acute or with a point to 1 mm long. *Secondary bracts* 1 per pseudanthium, 2-3 mm long, acute, entire, hyaline. *Pseudanthia* 2-6, all bisexual or a few lacking the stamen. *Stamen* free; filament capillary, 2.5-3 mm long; anther ellipsoid, 1-1.2 mm long. *Gynoecium* of 1-(2) carpels; styles deep pink; stigmatic papillae branched, c. 0.1 mm long. *Seed* ovoid, 0.7-0.9 mm long; testa smooth, stramineous.

Notes

C. monogyna is the Tasmanian representative of a complex which also includes *C. ciliata* (Hook.f.)Druce of New Zealand and *C. philippinensis* Merr. of Malesia and New Guinea. These entities differ mainly in the number of pseudanthia and carpels, ie. in the resources devoted to seed production as an adaptation to their differing habitats (Table 2). It is possible that a common ancestor of the complex was more widespread along the Great Dividing Range during the Pleistocene glacial periods of lowered treelines, and the relict populations have subsequently diverged.

The differences between the two Tasmanian taxa support their recognition at subspecies level only. Differences in leaf morphology between the type of subsp. *paludicola* and specimens of subsp. *monogyna* noted by Curtis (1985) were not found to be consistent throughout the whole range of specimens examined.

	Pseudanthia/head	Carpels/pseudanthium
C. ciliata (Edgar, 1960)	2-3-(4)	(1)-2
C. monogyna subsp. *monogyna*	2	1-(2)
C. monogyna subsp. *paludicola*	4-6	1
C. phillipinensis (Ding Hou, 1957)	2-4-(7)	2-4

Table 2. Parameters differentiating members of the *C. ciliata* complex

Key to subspecies

Pseudanthia 2 per head ..... 7a. subsp. *monogyna*
Pseudanthia 4-6 per head ..... 7b. subsp. *paludicola*

7a. subsp. **monogyna.**

Pseudanthia 2 per head, all bisexual. Carpels 1-(2) per pseudanthium.

Distribution (Map 5)

Tasmania: widespread in the south and west from near sea-level to 1100 m altitude, extending to Cradle Mountain and Lake St. Clair.

Ecology

Perennial in wet heath and alpine herbfield on poorly drained sands, gravels and peat. *Flowers* December to February.

Selected specimens examined (total 42)

TASMANIA: Lake St Clair, 19.i.1949, *S.T. Blake 18348* (HO); Lake Dobson, 22.i.1949, *N. Burbidge 3271* (HO); Port Davey, 12.ii.1971, *W. Curtis* (HO); Hartz Mountains, 12.xii.1968, *J. Hemsley 6535* (HO); Snug Plains, 28.i.1960, *W. Jackson* (HO 23894); Eldon Peak, 14.i.1981, *S. Jarman 95* (HO); Mt Counsel, 16.iii.1980, *A. Moscal 148* (HO); Lake Rhona, Denison Range, i.1977, *P. Tyler s.n.* (HO 31455); Mt Field National Park, 14.ii.1989, *N. Walsh 2299* (MEL).

7b. subsp. **paludicola** (W.M. Curtis) D.A. Cooke, comb. and stat. nov.

Centrolepis paludicola W.M. Curtis, Brunonia 7:298 (1985), basionym.

Type: Trappes Inlet, new Lake Pedder near Strathgordon, 28.i.1980, *D.I. Morris 8048* (Holo.: HO 33310!; iso.: MEL 1522861!; CANB, CHR, K, NSW n.v.).

Pseudanthia 4-6 per head, bisexual or some lacking the stamen. Carpel always solitary. Fig. 8.

Distribution (Map 5)

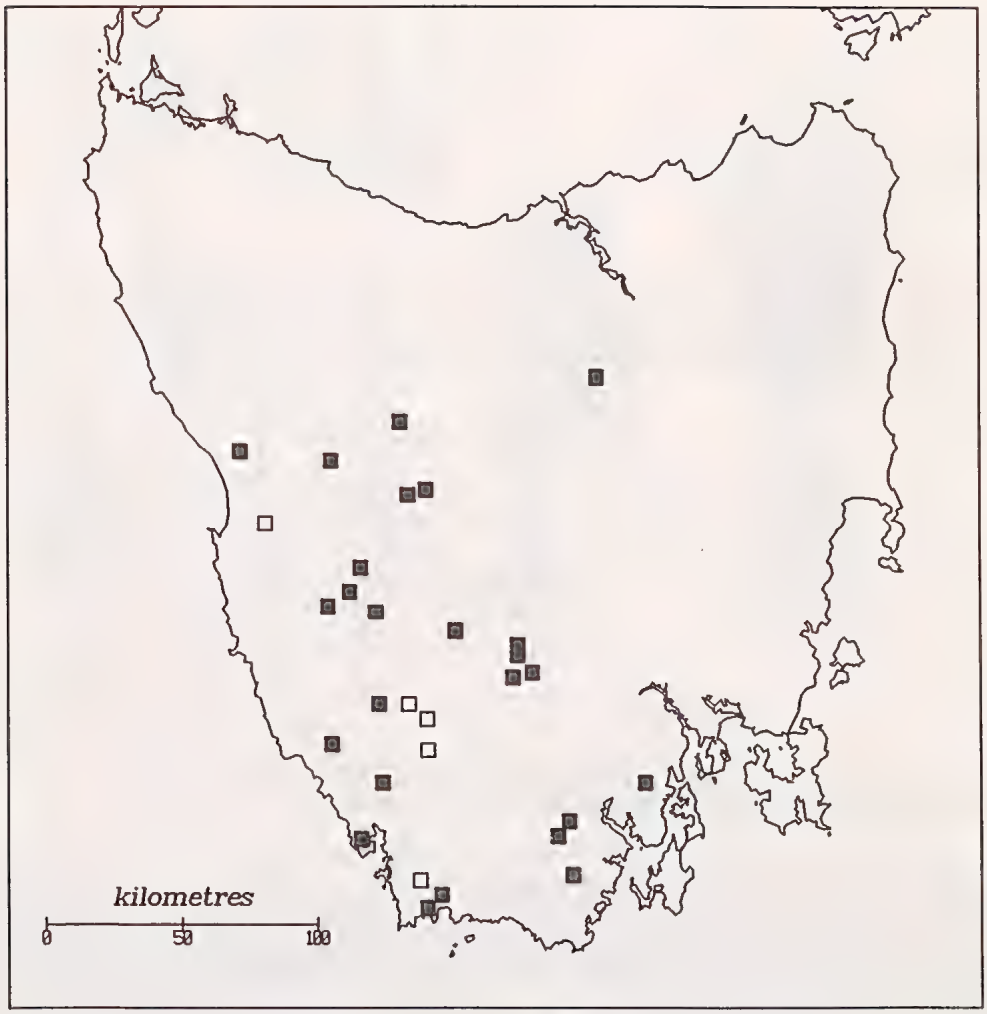
Tasmania: scattered in the south-west, from near sea-level to 350 m altitude.

Ecology

Perennial, in wet heaths on quartz sands and other alluvial soils. *Flowers* December to February.

Specimens examined (total 8)

TASMANIA: Melaleuca Inlet, Bathurst Harbour, 12.ii.1971, *W. Curtis* (HO 53789); McPartlan Pass, 42°51'S 146°10'E, 3.xii.1985, *W. Curtis* (HO; MEL); cultivated ex Lake Pedder, 1.xii.1972, *W. Curtis* (HO; MEL); Howard Plains, 20.i.1949, *L. Johnson s.n.* (HO); Trappes Inlet, Lake Pedder, 11.i.1980, *D. Morris 8018* (AD; HO); Lake Pedder, 27.ii.1971, *M. Roper* (MEL 527329); old Lake Pedder shore, 14.iii.1971, *P. Tyler* (AD 99127035).



Map 5. Distribution of *Centrolepis monogyna* subsp. *monogyna* ■ and subsp. *paludicola* □.

8. **Centrolepis strigosa** (R. Br.) Roemer & Schultes, Syst. Nat. 1:43 (1817); Kunth., Enum. Pl. 3:489 (1841); Hieron., Abh. Naturf. Ges. Halle 12:215 (1873); Benth., Fl. Austral. 7:207 (1878); Tate, Handb. Fl. Extratrop. S. Aust. 178 (1890); C. Moore, Handb. Fl. N.S.W. 442 (1893); Rodway, Tasm. Fl. 232 (1903); J. Black, Fl. S. Aust. 1:102 (1922); Ewart, Fl. Vict. 261 (1931); J.H. Willis, Handb. Pl. Vict. 1:279 (1962); N. Burb. & M. Gray, Fl. A.C.T. 92 (1970); N. Beadle et al., Fl. Sydney Reg. 591 (1972); Cooke in Jessop & Toelken, Fl. S. Aust. 4:1828 (1986).

Devauxia strigosa R. Br., Prodr. 252 (1810), basionym; Nees in Lehm., Pl. Preiss. 2:70 (1846); Steudel, Syn. Pl. Glum. 2:267 (1855).

Type: saxes prope Bald Head, King Georges Sound [W.A.], xii.1801, Brown sub Bennett No.5831 (Lecto. chosen here: BM!; syn.: CANB 67855!).

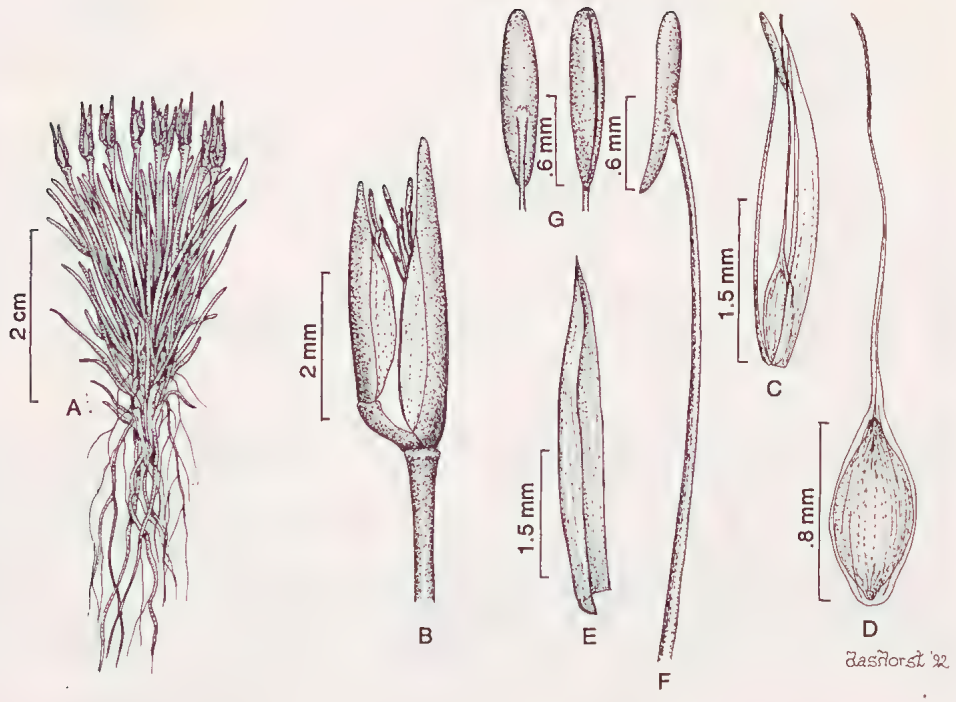


Fig. 8. *Centrolepis monogyna* subsp. *paludicola*. A, habit; B, head; C, pseudanthium with secondary bract; D, gynoecium; E, secondary bract; F, stamen; G, anther, two views. (Based on *D.I. Morris 8018*: AD).

Tufted annual 2-11 cm high, softly herbaceous, sometimes purplish after flowering. *Roots* numerous, branched. *Stem* repeatedly branching from the lower axils, forming internodes of negligible length. *Leaves* basal, very numerous, regularly radiating in a false spiral phyllotaxy throughout the tuft; sheath 2-8 mm long, membranous with hyaline margins, pilose, passing into a straight linear-subulate lamina 7-30 mm long, c. 0.4 mm wide, pilose with patent hairs or rarely glabrous; apex acute, mucronate. Uppermost leaf reduced to an obtuse glabrous veinless hyaline cataphyll 3-6 mm long. *Scape* terete, filiform, 1-10 cm long, glabrous or with fine lax hairs. *Head* terete, broadly ovoid, 2-4 mm wide. *Primary bracts* separated by an internode 1-2 mm long, rounded on the back, 3-5-veined, gaping at anthesis, similar; sheath broadly cymbiform, 2-3 mm long, herbaceous, strigose to glabrous with narrow hyaline margins, abruptly contracted into a glabrous mucro 0.5-1.3 mm long. *Secondary bracts* 2 per pseudanthium, hyaline, 2-2.5 mm long, obtuse to truncate, erose; additional secondary bracts present between pseudanthia. *Pseudanthia* 10-20, all bisexual. *Stamen* free; filament capillary, 2-5 mm long; anther ovoid, 0.5-1.1 mm long. *Gynoecium* of 4-8 carpels; styles c. 2 mm long, connate at the base, pale brown; stigmatic papillae simple, c. 0.03 mm long. *Seed* ovoid, c. 0.5 mm long; testa smooth, stramineous.

Key to subspecies

1. Anther completely exserted beyond the bracts; leaf lamina bearing 20-40 hairs per millimetre ..... 8c. subsp. *rupestris*

Anther not exserted, partly concealed by the secondary bracts; leaf lamina bearing fewer than 16 hairs per millimetre ..... 2.

2. Primary bracts both glabrous or bearing a few 2-5-celled hairs ..... 8b. subsp. *pulvinata*

Primary bracts both strigose with numerous 4-8-celled hairs, or rarely one of the bracts subglabrous ..... 8a. subsp. *strigosa*

8a. subsp. **strigosa.**

Devauxia patersonii R. Br., Prodr. 252 (1810); Steudel, Syn. Pl. Glum. 267 (1855).

Centrolepis patersonii (R. Br.) Roemer & Schultes, Syst. Nat. 1:43 (1817); Kunth., Enum. Pl. 489 (1841); Hieron., Abh. Naturf. Ges. Halle 12:214 (1873).

Centrolepis strigosa var. *patersonii* (R. Br.) Benth., Fl. Austral. 7:208 (1878).

Type: Port Jackson [N.S.W.], 1803, *Brown* sub Bennett No.5832 (Holo.: BM!).

Devauxia tenuior R. Br., Prodr. 252 (1810); Steudel, Syn. Pl. Glum. 267 (1855).

Centrolepis tenuior (R. Br.) Roemer & Schultes, Syst. Nat. 1:43 (1817); Kunth., Enum. Pl. 489 (1841); J.D. Hook., Fl. Tasman. 2:76 (1858); Hieron., Abh. Naturf. Ges. Halle 12:214 (1878).

Centrolepis strigosa var. *tenuior* (R. Br.) Benth., Fl. Austral. 7:208 (1878).

Type: Kings Island [Tas.], iv.1802, *Brown* sub Bennett No. 5830 (Lecto. chosen here: BM!; syn.: CANB 67854!, CANB 67856!, MEL 535281!, DBN n.v.).

Centrolepis aemula Rudge, Trans. Linn. Soc. London 10:284 (1811).

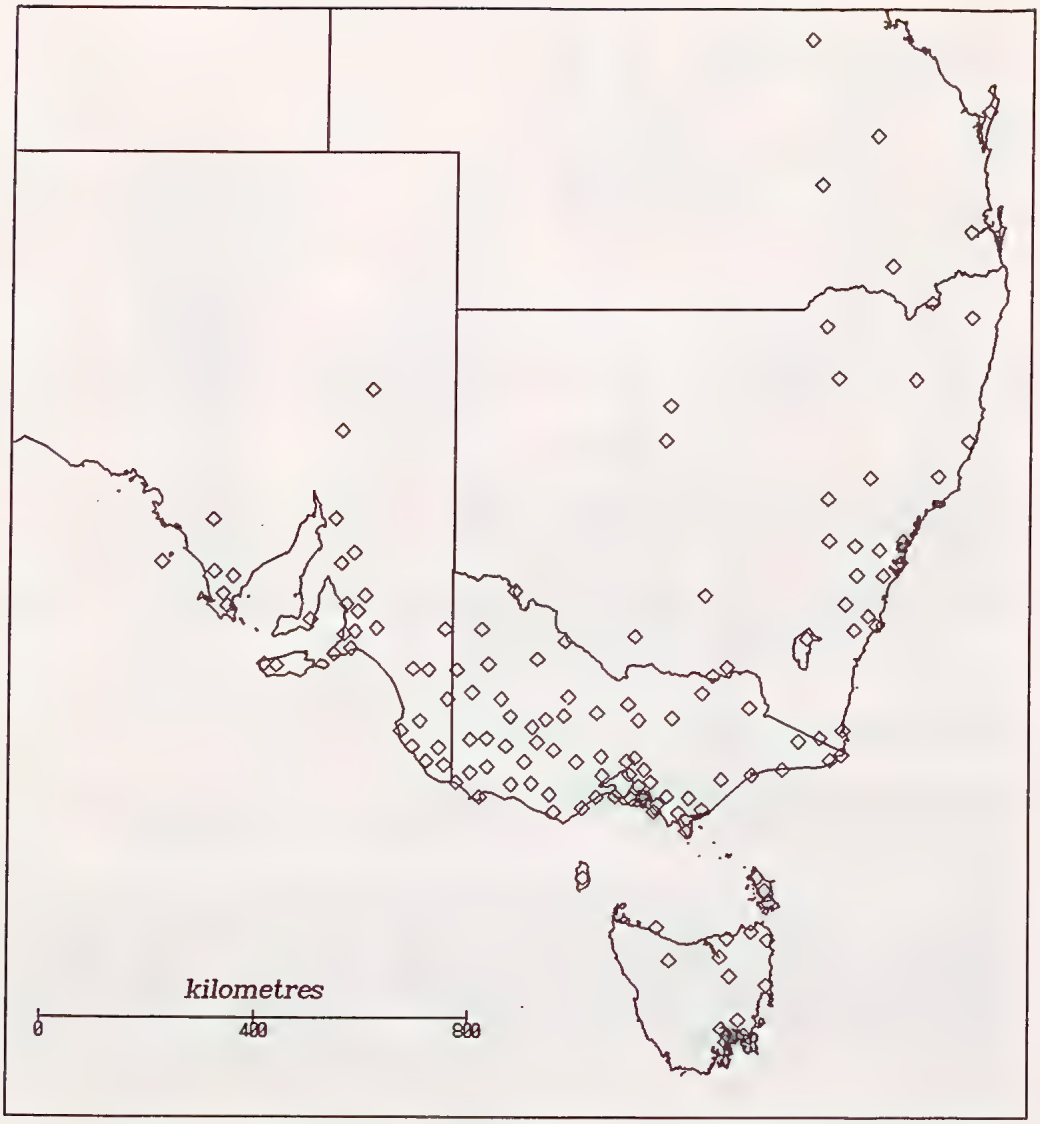
Type: fig.2, t.12 loc. cit.

Tufted herb to 11 cm high. *Leaf lamina* linear-subulate, 7-30 mm long, 0.2-0.5 mm wide, pilose with 3-15 weakly-spreading hairs per mm; apices tapering into mucros. *Scape* 1-10 cm long, glabrous or sparsely pubescent with lax crisped hairs, green to reddish. *Primary bracts* densely strigose with 5-8-celled hairs or the inner bract subglabrous; hyaline margins erose to erose-ciliate. *Filament* 2-3.5 mm long; anther 0.5-0.8 mm long, not exserted from head. Fig. 9.

Distribution (Map 6)

Western Australia: restricted to the south coast east of Albany. *South Australia*: widespread in near-coastal regions, extending to the Flinders Ranges and Murray mallee. *Queensland*: on the east coast and Dividing Range up to 20°S. *New South Wales*: widespread along the Coast, Tablelands and Western Slopes. *Victoria*: widespread throughout the State except in forests and the alps. *Tasmania*: Common in the north and east.

Also occurs as an adventive in the North Island of New Zealand (Healy & Edgar, 1980).



Map 6. Distribution of *Centrolepis strigosa* subsp. *strigosa* in eastern Australia.

Ecology

Winter annual occurring in heath, scrub, mallee, woodland and open forest on sand and infertile soils. *Flowers* September to November.

Notes

The BM sheet includes most of Brown's material with his annotations, and is here chosen as the lectotype.

Fig 9. *Centrolepis strigosa* subsp. *strigosa*. A, habit; B, leaf; C, head; D, pseudanthium with secondary bracts; E, gynoecium; F, anther, three views. (Based on *A.G. Spooner 4766*: AD). — subsp. *rupestris*. G, habit; H, leaf; I, head; J, pseudanthium with secondary bracts; K, gynoecium; L, anther, three views. (Based on *P.G. Wilson 8751*: PERTH).

Notes cont.

C. tenuior was said to differ in its attenuate habit with scapes far exceeding the leaves, and *C. patersonii* in the glabrous or subglabrous inner primary bract. Plants with these characters developed to varying degrees are found throughout the range of subsp. *strigosa* intergrading completely with typical material, and there is no justification for reinstating these taxa even at varietal level.

Selected specimens examined (total 411)

WESTERN AUSTRALIA: Long Island, Recherche Archipelago, 11.xi.1950, *Willis s.n.* (MEL); Cape Le Grand, 6.x.1966, *Wilson 5549a* (PERTH).

SOUTH AUSTRALIA: Arcoona Creek, Gammon Ra., 16.ix.1956, *Eichler 12643* (AD); Aldinga Scrub, 13.x.1964, *Grivell s.n.* (AD); McLaren Flat, 30.x.1963, *Jackson 564* (AD); Wanilla Hills, 11.x.1958, *Whibley 2904* (AD).

QUEENSLAND: near Wallangarra, xi.1944, *Clemens s.n.* (BRI); Clayhole Creek 20 miles S of Yuleba, 9.xi.1958, *Johnson 677* (BRI); Fraser Island, i.1894, *Lovell s.n.* (BRI).

NEW SOUTH WALES: Bombah Point, Myall Lakes, 1.viii.1964, *Briggs s.n.* (NSW); Cobar, 1887, Curran 323 (MEL); Warrumbungle Range, x.1901, *Forsythe s.n.* (NSW); Crackerjack Rock W of Bathurst, 27.x.1963, *Ingram s.n.* (NSW); near Sassafras, 10.x.1950, *Johnson s.n.* (NSW).

VICTORIA: Lady Julia Percy Island, 22.x.1966, *Beauglehole 6643* (MEL); Little Desert National Park, 2.xi.1978, *Cooke 201* (MEL); Mt Sisters near Omeo Plains at 3600', n.d., *Stirling 115* (MEL); Quail Island, 22.xi.1952, *Willis s.n.* (MEL).

TASMANIA: Pittwater Causeway, 10.xii.1966, *Hemsley 6019* (NSW); Blackmans Bay, 16.xi.1930, *Rodway s.n.* (HO); Launceston, xii.1879, *Simson 1670* (MEL); Cape Barren Island, 22.x.1973, *Whinray 551* (MEL).

EXTRA-AUSTRALIAN: New Zealand: The Bluff, i.1890, *T. Kirk s.n.* (MEL).

8b. subsp. **pulvinata** (R. Br.) D.A. Cooke, comb. & stat. nov.

Devauxia pulvinata R. Br., Prodr. 252 (1810), basionym; Steudel, Syn. Pl. Glum. 2:267 (1855).

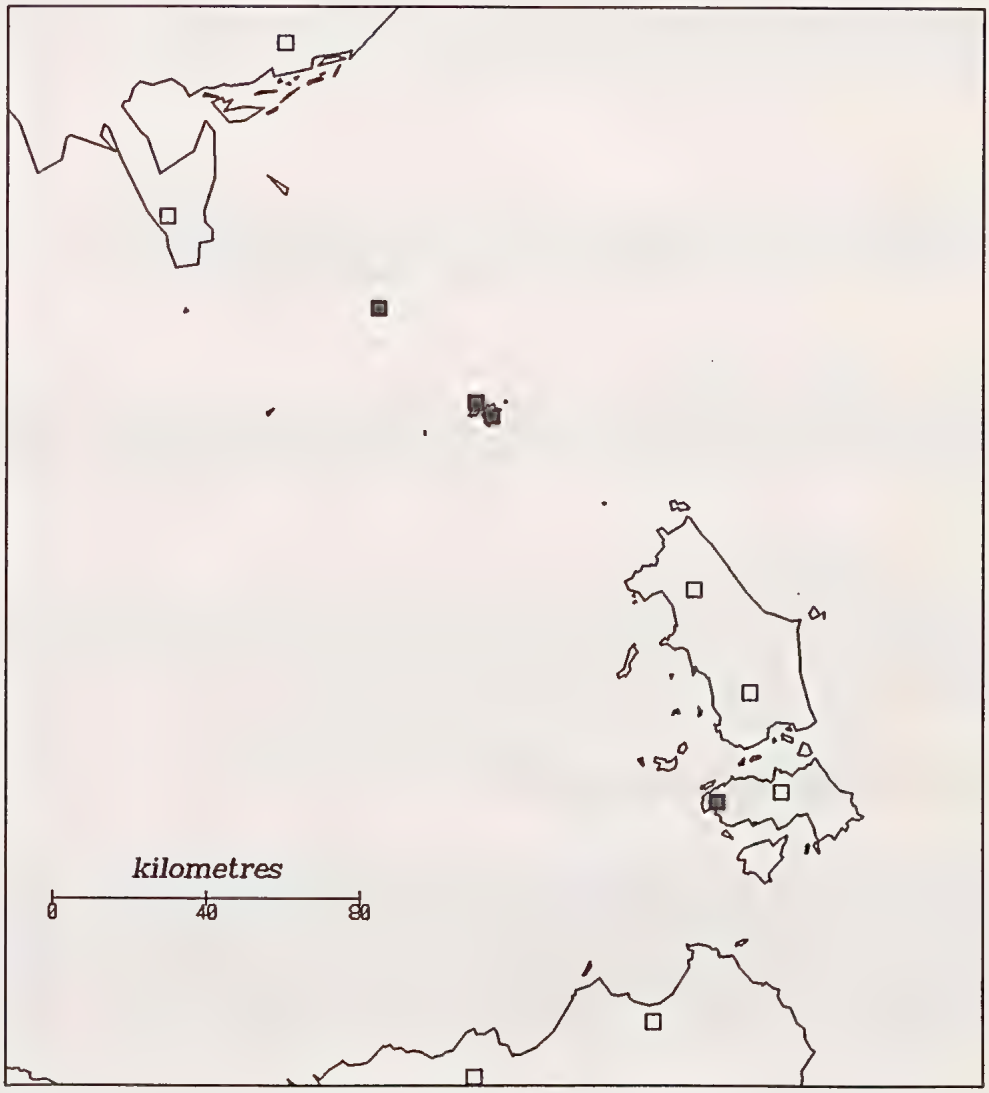
Type: Freestone Bay, Kents Group [Tas.], 19.xii.1803, *Brown* sub Bennett No. 5833 (Lecto. chosen here: BM!; syn.: CANB 67859!).

Centrolepis pulvinata (R. Br.) Roemer & Schultes, Syst. Nat. 1:43 (1817); Desv., Ann. Sci. Nat.(Paris) 13:42 (1828); Kunth, Enum. Pl. 3:489 (1841); J.D. Hook., Fl. Tasman. 2:77 (1858); Hieron., Abh. Naturf. Ges. Halle 12:214 (1873); Benth., Fl. Austral. 7:205 (1878); Rodway, Tasm. Fl. 232 (1903); W.M. Curtis, End. Fl. Tasm. 4:262 (1973).

Densely tufted herb to 4 cm high forming compact hemispherical cushions. *Leaf lamina* dorsiventrally compressed, linear-subulate, 6-18 mm long, 0.3-0.5 mm wide, glabrous or with 1-6 lax hairs per mm; apices tapering into mucros. *Scape* 0.8-3 cm long, usually subequal to the leaves, glabrous, green. *Primary bracts* glabrous or the outer bract with a few 2-5-celled hairs; hyaline margins ciliolate to subentire. *Filaments* 2-3 mm long; anther c. 0.6 mm long, not exserted from head.

Distribution (Map 7)

Tasmania: restricted to the islands of eastern Bass Strait, where recorded from Hogan Island, the Kent Group and Cape Barren Island of the Furneaux Group and sympatric with subsp. *strigosa*. A record from the Tasmanian mainland (Brown et al., 1983) is referable to subsp. *strigosa*.



Map 7. Distribution of *Centrolepis strigosa* subsp. *pulvinata* ■ and subsp. *strigosa* □ in Bass Strait.

Ecology

Winter annual in low open coastal vegetation. *Flowers* in July to October.

Notes

The BM sheet includes most of Brown's material with his annotations, and is here chosen as the lectotype.

The type of *C. pulvinata* represents an extreme population on Deal Island with completely glabrous leaves and bracts, and scapes no longer than the leaves. Other collections form a cline towards subsp. *strigosa*, having a similar habit and sparsely hairy leaves and bracts. Some material of subsp. *strigosa* from the north coast of Tasmania also shows some approach to this subspecies in its compact habit and reduced vestiture. Therefore, *C. pulvinata* is here treated as a subspecies of *C. strigosa*.

Conservation status

Like many other ruderals, it has not been adversely affected by habitat disturbance, and was reported as common along road verge drains on Deal Island (Whinray, 1971). A risk code of 2RC (rare but not threatened, and represented in reserves) applies.

Selected specimens examined (total 15)

TASMANIA: Hogan Island, i.1968, *Scarlett s.n.* (MEL); Cape Barren Island, 3.xi.1973, *Whinray 223* (AD); Erith Island, 12.xii.1970, *Whinray 384* (HO); Deal Island, Kent Group, 29.xii.1968, *Whinray 228* (HO); 26.xi.1970, *Whinray 1883* (MEL); 29.xi.1970, *Whinray s.n.* (MEL 526249); Freestone Bay, Deal Island, 8.vii.1971, *Whinray 1940A* (MEL).

8c. subsp. **rupestris** D.Cooke, subsp. nov.

Herba dense caespitosa usque ad 4 cm alta. *Laminae foliorum* omnino teretae, 7-11 mm longae, 0.2-0.3 mm latae, densissime strigosae pilibus rigidis patentibus 20-40 in quoque milimetro; apices in mucronibus abrupte contracti. *Scapus* 1.5-3.5 cm longus, glaber, nitens, rubescens. *Bracteae primariae* ambae dense strigosae pilis 5-8-cellularibus, marginibus hyalinis eroso-ciliatis. *Staminis* filamentum 3.5-5 mm longum, antheram trans apices bractearum primariarum ferentum. Anthera 0.8-1.1 mm longa. (Descriptio typi).

Type: Hickey Ricken Soak, 60 km N of Bullfinch, W.A., 24.viii.1970, *P.G. Wilson 8751* (Holo.: PERTH!; iso.: MEL 1517607!).

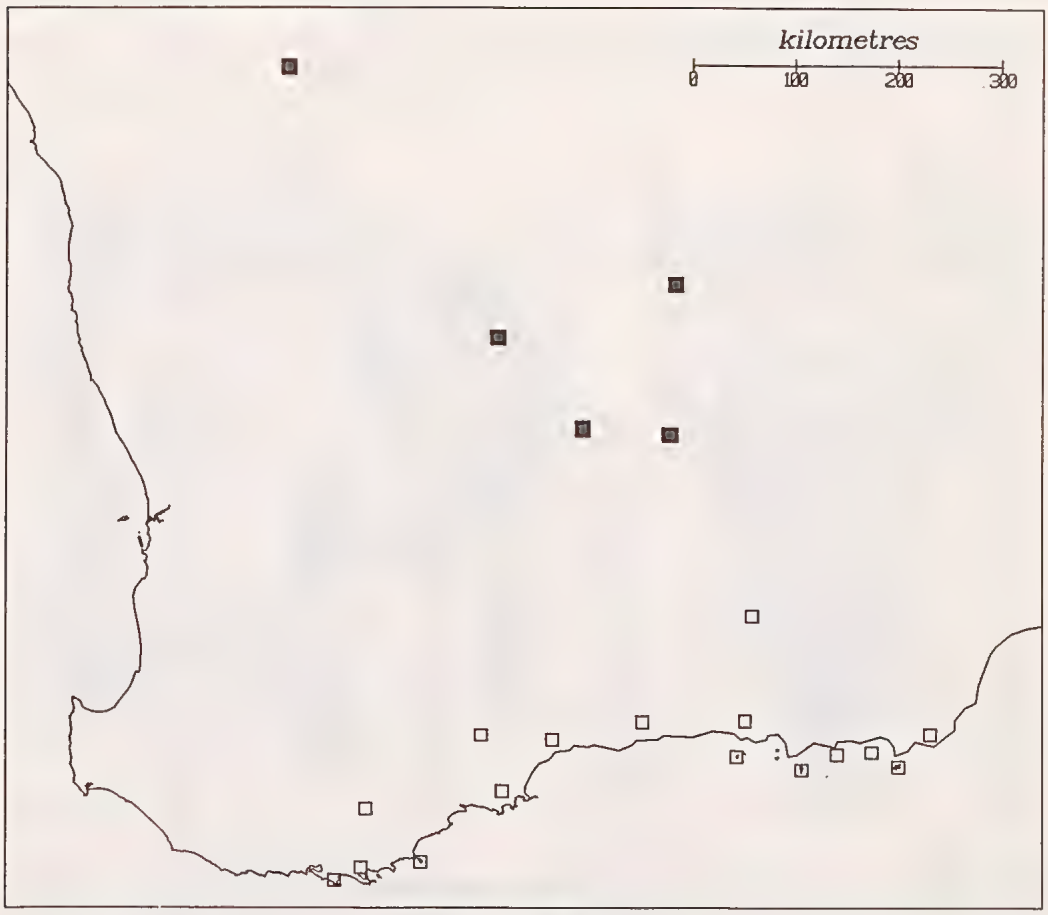
Densely tufted herb to 4 cm high. *Leaf lamina* quite terete, 7-11 mm long, 0.2-0.3 mm wide, very densely strigose with 20-40 rigidly spreading hairs per mm; apices abruptly contracted into mucros. *Scape* 1.5-3.5 cm long, glabrous, shiny, becoming reddish. *Primary bracts* both densely strigose with 5-8-celled hairs; hyaline margins erose-ciliate. *Filament* 3.5-5 mm long, bearing the anther beyond the apices of the primary bracts; anther 0.8-1.1 mm long. Fig. 9.

Distribution (Map 8)

Western Australia: restricted to the Austin and Coolgardie botanical districts in the Eremaean province around the 250 mm annual isohyet.

Ecology

Winter annual confined to moist microhabitats receiving runoff water, mainly around granite outcrops. *Flowers* in August to October.



Map 8. Distribution of *Centrolepis strigosa* subsp. *rupestris* ■ and subsp. *strigosa* □ in Western Australia.

Notes

Apparently parapatric with the more coastal subsp. *strigosa*.

Specimens examined

WESTERN AUSTRALIA: Woodline, n.d., *Cleland s.n.* (AD); 298 mile peg [479 km], Great Eastern Highway, 18.ix.1962, *George 4176* (PERTH); 29 miles [47 km] W of Mt Magnet, 11.ix.1966, *George 7964* (PERTH); Queen Victoria Rock, 8.xi.1976, *Wittwer 1933* (PERTH).

9. **Centrolepis exserta** (R. Br.) Roemer & Schultes, Syst. Nat. 1:44 (1817); Hieron., Abh. Naturf. Ges. Halle 12:215 (1873); F. Muell., Fragm. Phyt. Aust. 8:237 (1874); Benth., Fl. Austral. 7:208 (1878); Bailey, Queensl. Fl. 6:1720 (1902); Ewart & O.Davies, Fl. Northern Territory 66 (1917).

Devauxia exserta R. Br., Prodr. 253 (1810), basionym; Steudel, Syn. Pl. Glum. 2:267 (1855).

Type: East coast of New Holland, particular place forgotten [Qld], 1802, *Brown* sub Bennett No. 5827 (Holo.: BM!).

Centrolepis exserta var. *rubra* Bailey, Queensl. Fl. 6:1720 (1902); Compr. Cat. Queensl. Pl. 584, fig. 567 (1913).

Type: Fraser Island [Qld], *Lovell s.n.* (Holo.: BRI).

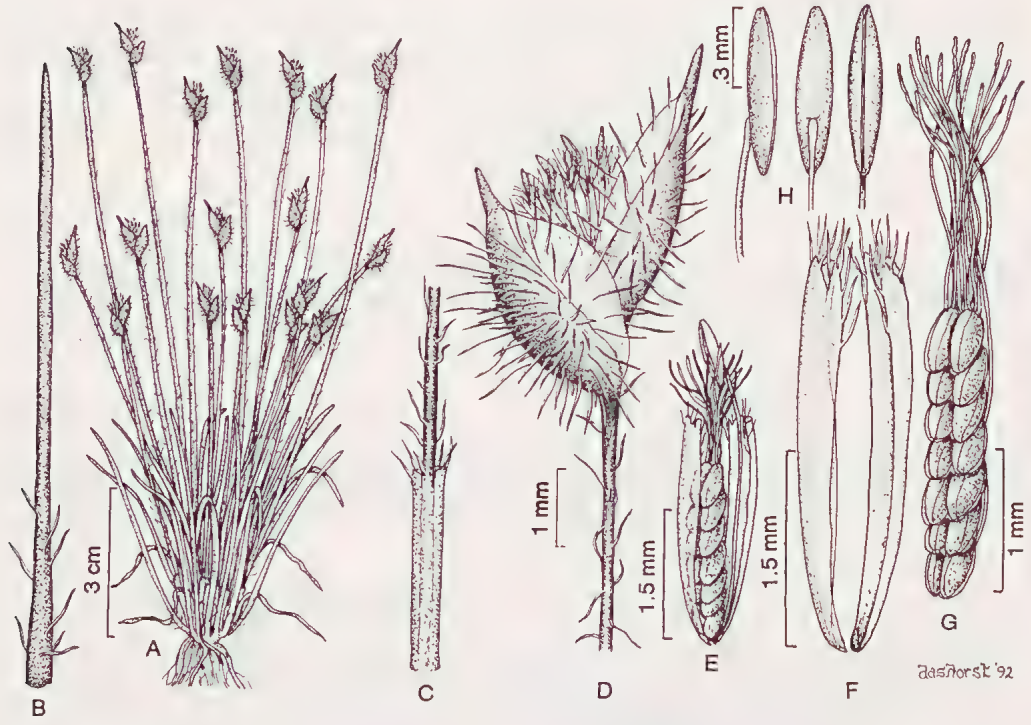


Fig. 10. *Centrolepis exserta.* A, habit; B, leaf; C, base of scape with cataphyll; D, head; E, pseudanthium with secondary bracts; F, secondary bracts; G, gynoecium; H, anther, three views. (Based on *P.K. Latz 27-19*: AD).

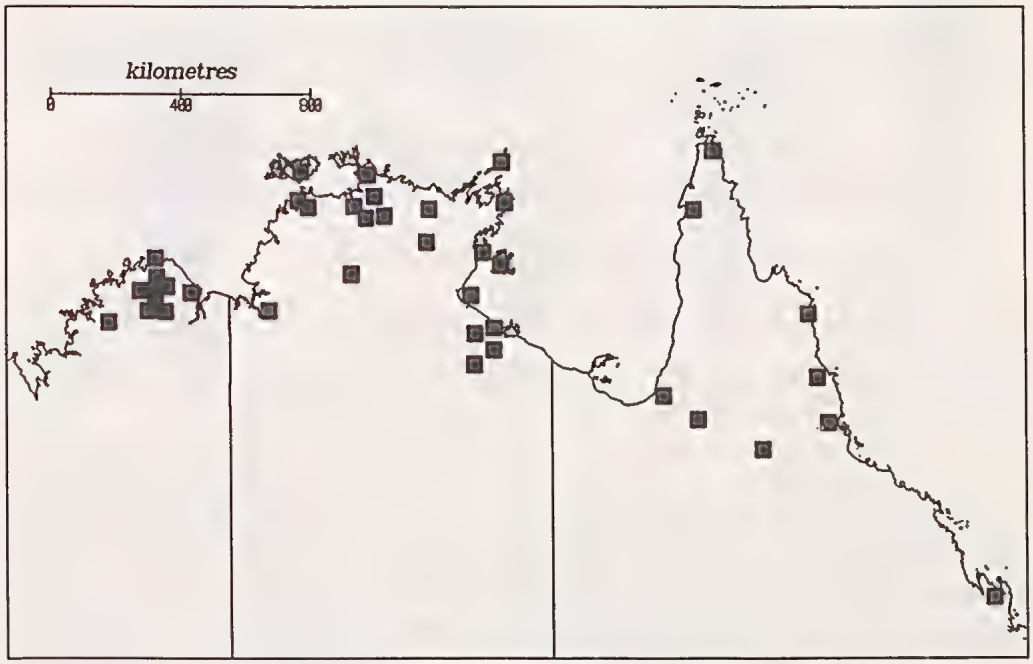
Annual 4-12 cm high, softly herbaceous, forming erect round tufts , often becoming purplish. *Roots* numerous, branched. *Stem* repeatedly branching from the lower axils, forming internodes of negligible length. *Leaves* basal, numerous, regularly radiating in a false spiral phyllotaxy throughout the tuft; sheath 2-6 mm long, membranous with hyaline margins, pilose, passing into a straight, linear-subulate lamina 8-30 mm long, c. 0.4 mm wide, sparsely pilose with patent hairs; apex acute, mucronate. Uppermost leaf reduced to an obtuse, glabrous, hyaline, veinless cataphyll 3-5 mm long. *Scape* terete, filiform, 3-11 cm long, pubescent with fine lax hairs or glabrescent. *Head* terete, narrowly ovoid, c. 2 mm wide. *Primary bracts* separated by an internode 1-3 mm long, rounded on the back, 3-veined, widely gaping at anthesis, similar; sheath narrowly cymbiform, 3-4 mm long, herbaceous, strigose with hairs frequently cystolithic, with broad erose-ciliolate hyaline margins, tapering into a glabrous point 0.5-1.2 mm long. *Secondary bracts* 2 per pseudanthium, hyaline, c. 3 mm long, obtuse, erose-fimbriolate, sometimes with s few hairs near the apex. *Pseudanthia* 10-25, all bisexual. *Stamen* free; filament capillary, 7-15 mm long; anther ellipsoid, 0.8-1.1 mm long. *Gynoecium* of 6-9 carpels; styles c. 2 mm long, pale brown, connate at the base only or free. Stigmatic papillae simple, 0.03 mm long. *Seed* ovoid, c. 0.5 mm long; testa smooth, stramineous. Fig. 10.

Distribution (Map 9)

Western Australia: in the Gardner and Fitzgerald districts of the Kimberley region. *Northern Territory*: widespread from Melville Island to about 16°S. *Queensland*: widespread from Cape York to about 20°S.

Ecology

Annual, growing during the summer wet season. Occurs on margins of streams and wetlands, and moist sites in woodland or grassland, mainly on sandy alluvial soils. *Flowers* in May to August.



Map 9. Distribution of *Centrolepis exserta.*

Notes

Centrolepis exserta is closely related to *C. strigosa*, with which it intergrades at the southern end of its range in Queensland. The two species show homologous variation in overall size, scape length, density of vestiture and degree of anthocyanin pigmentation, but can be reliably separated on the form of the primary bracts and the consequently more open head of *C. exserta.*

The variety *rubra* was described by Bailey as differing only in its smaller size and reddish or purplish colour, and appears to have been based on depauperate material of *C. exserta.*

Selected specimens examined (total 65)

WESTERN AUSTRALIA: Rocky Cove, Van Sittart Bay, 8.viii.1921, *Gardner 1519* (PERTH); 5 km W of Beverley Springs Hstd, 11.viii.1974, *George 12232* (PERTH); Galeola Creek, Drysdale River National Park, 13.viii.1975, *George 13791* (PERTH; CANB); Prince Regent River Reserve, 14.viii.1974, *Kenneally 2002* (PERTH).

NORTHERN TERRITORY: Maria island, 22.vii.1972, *C. Dunlop 3006* (MEL); 17 miles N Wilton River crossing, 15.i.1972, *Latz 2749* (AD; BRI; CANB; NT); Koongara, 8.vi.1978, *Rice 2924* (CANB); South Bay, Bickerton Island, 7.vi.1948, *Specht 492* (AD; BRI; CANB; MEL); Oenpelli, 31.x.1948, *Specht 1311* (BRI).

QUEENSLAND: Lockerbie, Cape York Peninsula, 1.v.1948, *L. Brass 18587* (CANB); army area, Shoalwater Bay, 23.vii.1973, *J. Edwards s.n.* (BRI); track to Pennefeather River, Cape York, 14.vi.1981, *Morton 1253* (MEL); ENE of Weipa Mission, 24.vii.1974, *R. Specht & R. Salt s.n.* (BRI).

10. **Centrolepis banksii** (R. Br.) Roemer & Schultes, Syst. Nat. 1:43 (1817); Kunth, Enum. Pl. 3:490 (1841); Hieron., Abh. Naturf. Ges. Halle 12:213 (1873); F. Muell., Fragm. Phyt. Aust. 8:237 (1874); Benth, Fl. Austral. 7:207 (1878); Bailey, Queensl. Fl. 6:1719 (1902); Ewart & O.Davies, Fl. Northern Terr. 65 (1917).

Devauxia banksii R. Br., Prodr. 253 (1810), basionym; Steudel, Syn. Pl. Glum. 2:267 (1855).

Type: Nova Cambria apud Endeavour River [Qld], 1770, *Banks & Solander* (Lecto. chosen here: BM!; syn.: CANB 67852!).

Devauxia pusilla R. Br., Prodr. 253 (1810); Steudel, Syn. Pl. Glum. 2:267 (1855).

Centrolepis pusilla (R. Br.) Roemer & Schultes, Syst. Nat. 1:44 (1817); Kunth, Enum. Pl. 3:490 (1841); Hieron., Abh. Naturf. Ges. Halle 12:211 (1873); Benth., Fl. Austral. 7:205 (1878); Bailey, Queensl. Fl. 6:1719 (1902).

Type: East coast of New South Wales within the tropic [Qld], 1802, *Brown* sub Bennett No. 5828 bis BM! (Lecto. chosen here as typical of the range of variation, and labelled "Desvauxia pusilla" by Brown. The other Brown collection mounted on the same sheet, from Shoalwater Bay, was not labelled with a name.)

Tufted annual 2.5-12 cm high, softly herbaceous, sometimes becoming purplish after flowering. *Roots* numerous, hardly branched. *Stem* repeatedly branching from lower axils forming internodes of negligible length. *Leaves* basal, numerous, somewhat lax, glabrous, regularly radiating in a false spiral phyllotaxy throughout the tuft; sheath 2-6 mm long, membranous with hyaline margins, passing into a straight linear-subulate lamina 8-45 mm long, c. 1 mm wide, apex acute, emucronate. Uppermost leaf reduced to an obtuse glabrous veinless hyaline cataphyll 3-5 mm long. *Scape* terete, 1.5-11 cm long, glabrous. *Head* terete, ovoid, 2-2.8 mm wide. *Primary bracts* separated by an internode 1-3 mm long, rounded on the back, 3-5-veined, gaping at anthesis; outer bract cymbiform, 3-5 mm long, herbaceous, obtuse or rarely apiculate, with broad hyaline entire to ciliolate margins; inner bract similar, 2.5-4 mm long, always obtuse. *Secondary bracts* 2 per pseudanthium, hyaline, c. 3 mm long, obtuse. *Pseudanthia* 9-25, all bisexual. *Stamen* very shortly adnate to gynoecium; filament capillary, 3-4 mm long; anther ellipsoid, c. 0.6 mm long. *Gynoecium* of 9-20 carpels; styles c. 2 mm long, pale brown, free. Stigmatic papillae simple, 0.03 mm long. *Seed* ovoid, c. 0.5 mm long; testa smooth, stramineous. Fig. 11.

Distribution (Map 10)

Western Australia: scattered in the Gardner and Fitzgerald botanical districts of the eastern Kimberley region. *Northern Territory*: mainly in Arnhem land, but also recorded from the Tanami Desert. *Queensland*: widespread from Cape York to about 18°S.

Also occurring in Vietnam and Hainan (Ding Hou, 1957) and in New Guinea (Royen, 1979).

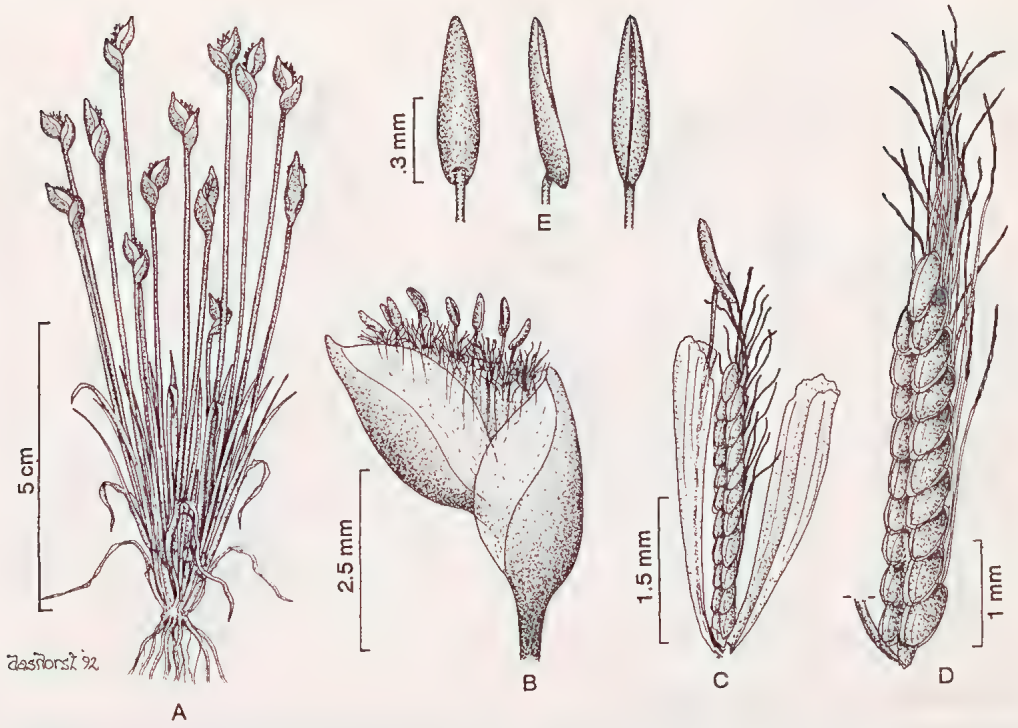


Fig. 11. *Centrolepis banksii*. A, habit; B, head; C, pseudanthium with secondary bracts; D, gynoecium; E, anther, three views. (Based on *D.E. Symon 7687*: AD).

Ecology

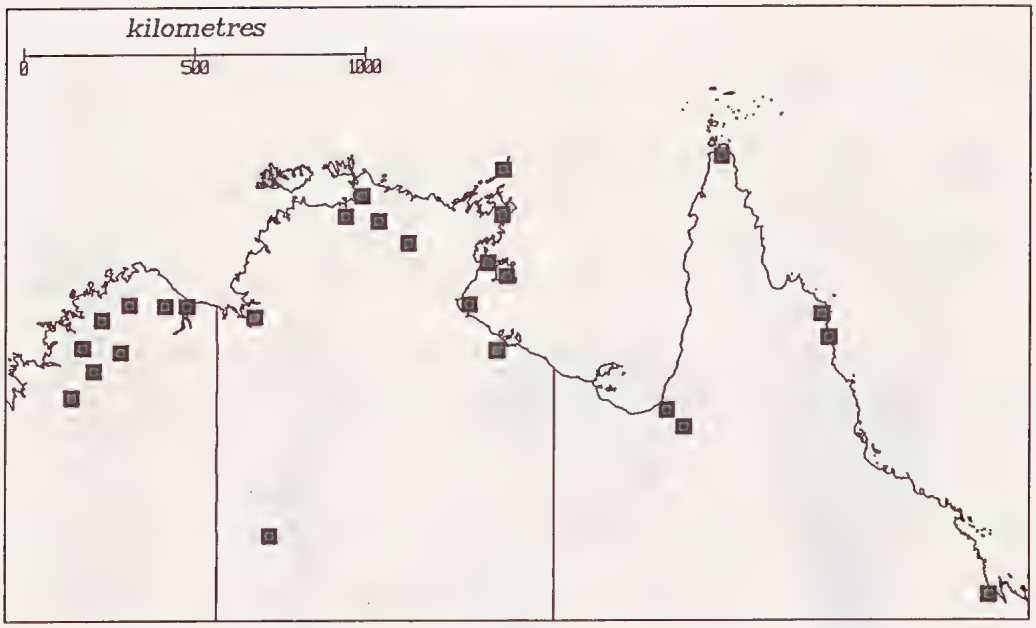
Annual, growing during the summer wet season. *Flowers* mainly May to August. Similar habitat to *C. exserta* and often found with it, but less common.

Notes

Centrolepis banksii appears closely related to *C. strigosa* and also to the Asian species *C. asiatica* Merr. and *C. hainanensis* Merr. & Metcalfe.

Brown's *Devauxia pusilla* was based on depauperate plants with scapes 1.5-3.5 mm long but agreeing with all characters of *C. banksii*. The name *C. pusilla* was misapplied by Specht (1958) to a scapeless annual monocot from *Melaleuca* swamps in Arnhem Land; this plant was later referred to *Trithuria* in the family Hydatellaceae (Cooke, 1981).

An aberrant specimen from a run-on area in the Tanami desert, *Latz 9380*, has a robust condensed habit with relatively numerous pseudanthia. These characters may be adaptations to the extreme environment, but whether they are ecadic or ecotypic in nature is unclear and to base a new taxon on this specimen would be unjustified.



Map 10. Distribution of *Centrolepis banksii.*

Selected specimens examined (total 34)

WESTERN AUSTRALIA: Isdell R. near Grace Knob, v.1905, *Fitzgerald 932* (PERTH); Drysdale River above Mogunda Ck, 6.viii.1975, *George 13471* (PERTH); Orchid Creek below Carson Escarpment, 9.viii.1975, *George 13618* (CANB, PERTH); Nymphaea Creek, Drysdale River National Park, 13.viii.1975, *Kenneally 4280* (PERTH).

NORTHERN TERRITORY: Maria Island, 13.vii.1972, *Dunlop 2813* (CANB); Wessel Islands, 2.x.1972, *Latz 3581* (CANB); 9 km SE of Sangsters Bore, 6.viii.1982, *Latz 9380* (AD); Little Lagoon, Groote Eylandt, 27.v.1948, *Specht 411* (CANB; MEL); Obiri Rock Track, Kakadu, 19.iv.1980, *Telford 7727* (CBG).

QUEENSLAND: 105 km SE Normanton, 17.vii.1974, *Ollerenshaw 1481D* (CBG); 2 km NE Bamaga airstrip, 25.viii.1978, *Paijmans 3009B* (CANB); 27 miles NW Cooktown, 18.vi.1972, *Telford 1398* (BRI; CBG).

11. **Centrolepis pilosa** Hieron., Abh. Naturf. Ges. Halle 12:216 (1873); Benth., Fl. Austral. 7:207 (1878); Diels & Pritzel, Bot. Jahrb. Syst. 35:95 (1904); Blackall & Grieve, West. Aust. Wildfl. 1:60 (1954); Rye in Marchant et al., Fl. Perth Reg. 2:294 (1987).

Type: Western Australia, *J. Drummond 931* (Holo.: B, n.v.; iso.: MEL 57717!, MEL 577261!). The holotype was cited by Hieronymus as located at the Vienna Herbarium (W), but was later removed to Berlin-Dahlem; the sheet is annotated "Hb Hieronymus".

Annual 2.5-9 cm high, softly herbaceous, forming erect tufts, never purplish. *Roots* numerous, branched. *Stem* sparsely branching from the lower axils, forming internodes of negligible length. *Leaves* basal, numerous, very obscurely distichous; sheath 2-3 mm long, membranous with hyaline margins, strigose with multicellular hairs, passing into a linear-subulate arcuate subterete lamina 8-20 mm long, c. 0.3 mm wide, glabrous or with scattered hairs or unicellular papillae; apex obtuse or mucronulate. Uppermost leaf reduced to a veinless obtuse hyaline cataphyll, 2-4 mm long, glabrous or with a few hairs near the apex. *Scape* terete, filiform, 1-8 cm long, glabrous. *Head* ovoid, 2-2.5 mm wide. *Primary bracts* subopposite, similar, rounded on the back, 3-5-veined, gaping at anthesis; sheath broadly

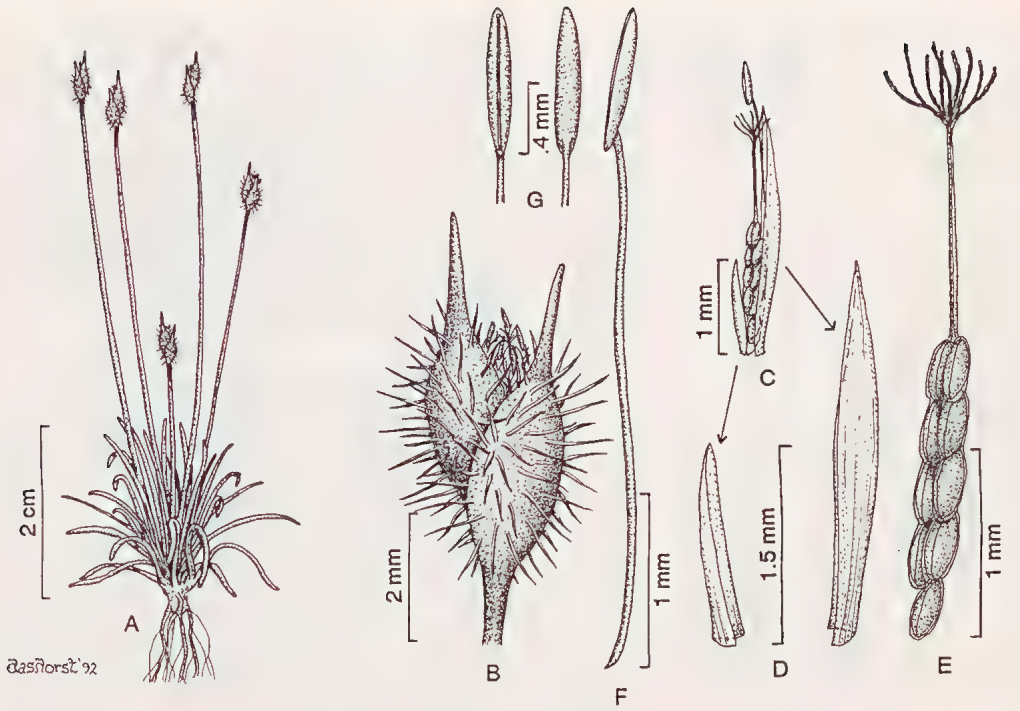


Fig. 12. *Centrolepis pilosa.* A, habit; B, head; C, pseudanthium with secondary bracts; D, secondary bracts; E, stamen (F); F, gynoecium (E); G, anther, two views. (Based on *R.J. Chinnock 4109*: AD)

cymbiform, 2.5-3.5 mm long, herbaceous, densely strigose with narrow, ciliolate to entire hyaline margins, abruptly contracted into an arcuate, terete, leaf-like lamina 2-3 mm long, obtuse, glabrous or minutely papillate. *Secondary bracts* 2 per pseudanthium, c. 2.5 mm long, obtuse, finely erose, hyaline. *Pseudanthia* 8-12, all bisexual. *Stamen* free; filament capillary, c. 3 mm long; anther ellipsoid, 0.8-1 mm long. *Gynoecium* of 5-8 carpels; styles c. 1.5 mm long, connate for about half their length, bright pink; stigmatic papillae branched, 0.04-0.1 mm long. *Seed* ovoid, 0.5 mm long; testa smooth, stramineous. Fig. 12.

Distribution (Map 11)

Western Australia: widespread and common in the Avon, Darling and Irwin botanical districts from the Irwin River to Albany, mainly between the 500-1000 mm annual isohyets but with outlying populations to the 350 mm isohyet.

Ecology

Winter annual, on sandy or skeletal soils over granite, limestone and laterite. Often found in lithoseral moss beds but absent from swampy sites. *Flowers* in September to October.

Notes

Close to *C. strigosa*, which replaces it east of Albany; readily recognised by the longer arcuate bract laminae.

Map. 11. Distribution of *Centrolepis pilosa.*

Selected specimens examined (total 17)

WESTERN AUSTRALIA: Dryandra State Forest, 22.xii.1971, *Burbidge 7894A* (CANB); 296 km from Mt Magnet on Geraldton road, 29.x.1963, *Goodall 2150* (PERTH); Darkan townsite, 6.x.1976, *Keighery 877* (PERTH); Mara Bridge, Pallinup River, 6.ix.1974, *Newbey 4243* (PERTH); 8 km E Dandaragan West, 2.x.1972, *Paust 1136* (PERTH); Manjimup, 28.ix.1948, *Royce 2720* (PERTH); Tutanning Reserve, 18.ix.1962, *Royce 7546* (PERTH); Watheroo National Park, 4.x.1971, *Royce 9541* (PERTH); 13 miles W of Coorow, 30.ix.1966, *Scrymgeour 1388* (PERTH); Helena Valley, 26.ix.1977, *Seabrook 304* (PERTH); Nambung National Park, 12.x.1978, *Spencer 13* (MEL); 5 km S of Eneabba, 11.x.1978, *Spencer 14* (MEL).

12. **Centrolepis fascicularis** Labill., Nov. Holl. Pl. 1:7-8, t.1 (1804); Roemer & Schultes, Syst. Nat. 1:43 (1817); Desv., Ann. Sci. Nat. (Paris) 13:42 (1828); Kunth, Enum. Pl. 3:489 (1841); J.D. Hook., Fl. Tasman. 2:77 (1858); Hieron., Abh. Naturf. Ges. Halle. 12:216 (1873); Benth., Fl. Austral. 7:207 (1878); Tate, Handb. Fl. Extratrop. S. Aust. 177 (1890); Bailey, Queensl. Fl. 6:1719 (1902); Rodway, Tasm. Fl. 232 (1903); Bailey, Weeds Susp. Poison Pl. Queensl. 209 (1906); J. Black, Fl. S. Aust. 1:102 (1922); Ewart, Fl. Vict. 261 (1931); Ding Hou, Fl. Males. 5:424 (1957); J.H. Willis, Handb. Pl. Vict. 1:279 (1962); N. Beadle et al., Fl. Sydney Reg. 591 (1972); Cooke in Jessop & Toelken, Fl. S. Aust. 4:1826 (1986).

Type: in capite Van Diemen [Tas.], 1792, *Labillardière* (Holo.: FI, n.v.; iso.: B, microfiche, BM, n.v.).

Devauxia billardieri R. Br., Prodr. 252 (1810); Steudel, Syn. Pl. Glum. 2:267 (1855).

Type: in paludosis prope Sydney [N.S.W.], *Brown* (Lecto. chosen here: BM!; syn.: MEL 535282!; MEL 536057!).

Centrolepis cuspidigera Rudge, Trans. Linn. Soc. London 10:283 (1811).

Type: fig. 1, t.12 loc. cit.

Devauxia longifolia Gaudich., Voy. Uranie 419 (1829), ut "Desvauxia".

Centrolepis longifolia (Gaudich.) Kunth, Enum. Pl. 3:489 (1841).

Type: in Novae Hollandiae ora orientali (Port Jackson) [N.S.W.], *Gaudichaud* (Holo.: P, photo!).

Perennial, softly herbaceous, never becoming purplish, forming dense cushions 3-20 cm diam. *Stems* numerous, branching, with numerous adventitious roots. *Leaves* numerous, very obscurely distichous; sheath 2-6 mm long, membranous with hyaline margins, pilose with multicellular hairs, passing into a linear-subulate subterete lamina 8-45 mm long, c. 0.8 mm wide, glabrous or pilose with scattered hairs; apex acute, mucronulate. Uppermost leaf reduced to a veinless subacute hyaline cataphyll, 3-5 mm long, glabrous. *Scape* terete,

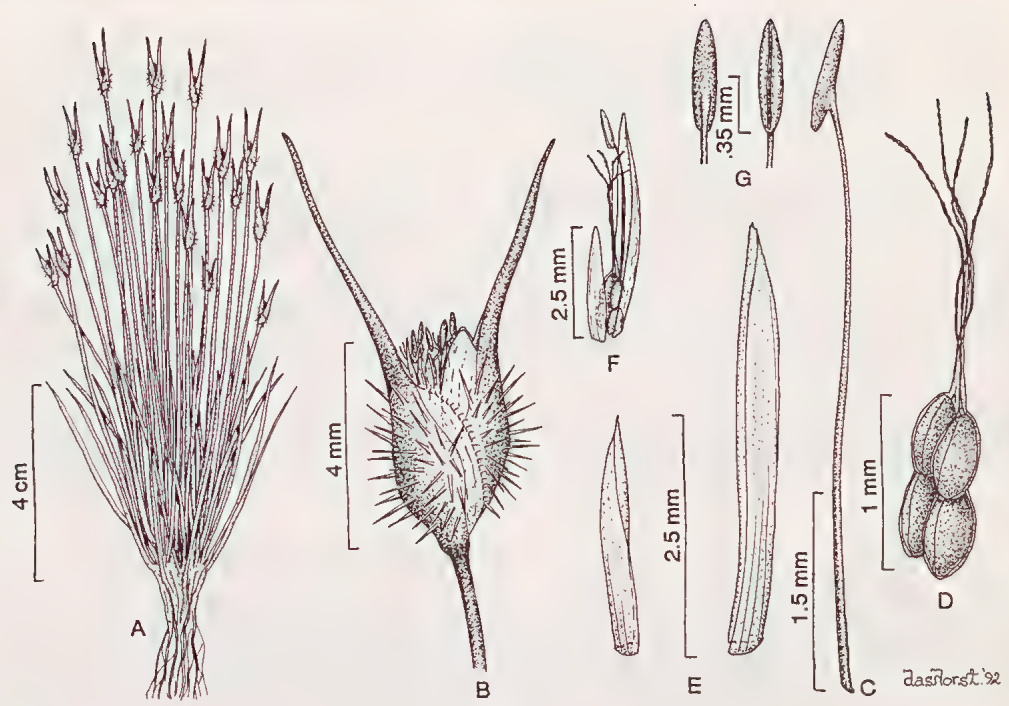


Fig. 13. *Centrolepis fascicularis*. A, habit; B, head; C, pseudanthium with secondary bracts; D, gynoecium; E, secondary bracts; F, stamen; G, anthers, two views. (Based on *J.B. Cleland AD 97226057*).

filiform, 2-6 cm long, glabrous. *Head* ovoid, 2-3.5 mm wide. *Primary bracts* subopposite, similar, rounded on the back, 3-veined, gaping at anthesis; sheath broadly cymbiform, 2.5-3.5 mm long, herbaceous, usually densely strigose with narrow hyaline margins, tapering into a subulate leaf-like lamina 1-3 mm long, acute, glabrous or minutely papillate. *Secondary bracts* 2 per pseudanthium, 2.5-3.5 mm long, obtuse or truncate, hyaline. *Pseudanthia* 7-14, all bisexual. *Stamen* free; filament capillary, 2.5-4 mm long; anther ellipsoid, 0.6-0.8 mm long. *Gynoecium* of 2-4 carpels; styles c. 2 mm long, connate at the base only, pale brown; stigmatic papillae simple, c. 0.04 mm long. *Seed* ovoid, c. 0.5 mm long; testa smooth, stramineous. Fig. 13.

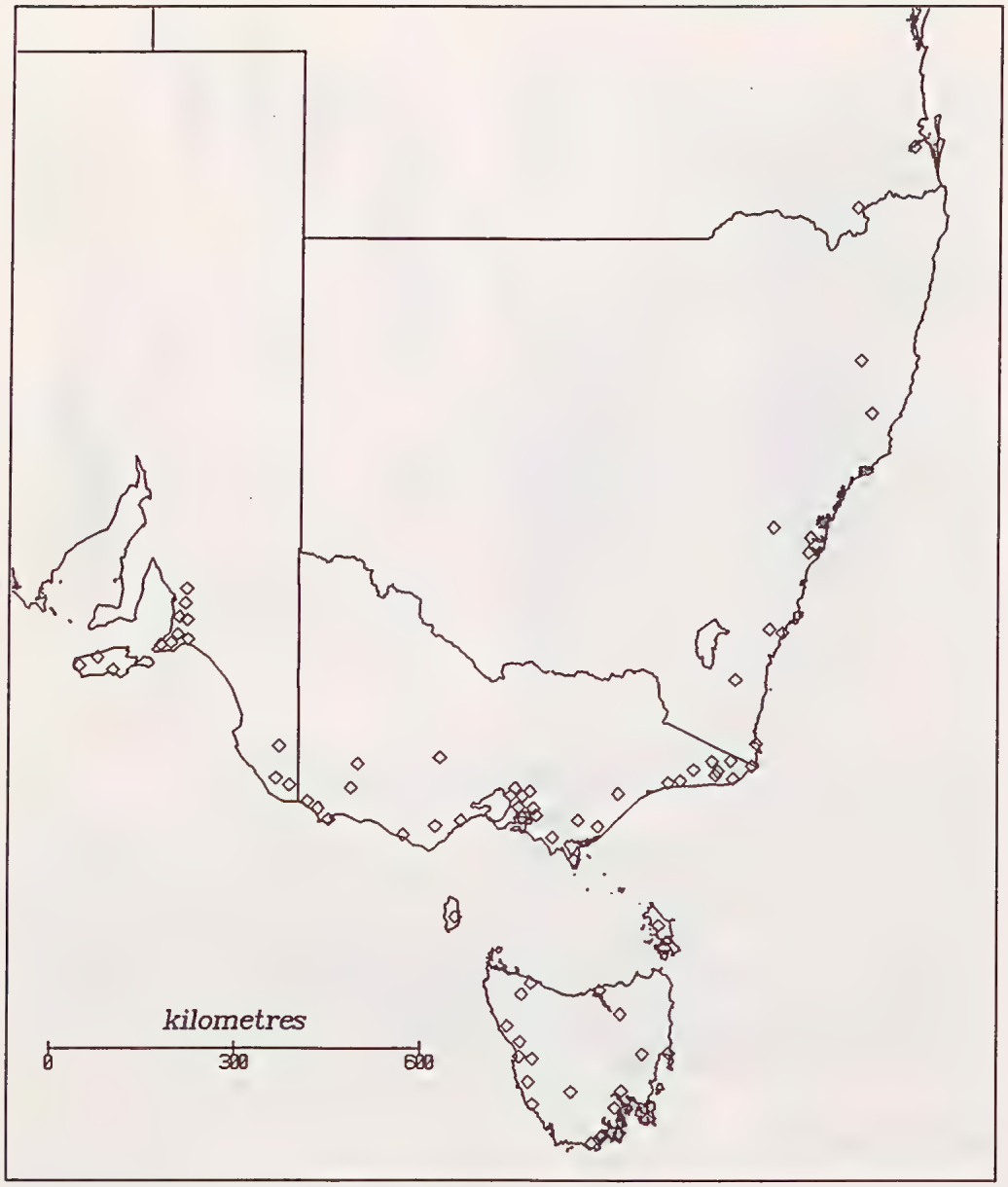
Distribution (Map 12)

Western Australia: possibly introduced at Bramley in the far south-west. *South Australia*: Kangaroo Island, Southern Lofty and lower South-east. *Queensland*: Along the Great Dividing Range in the south-east. *New South Wales*: widespread along the Coast and Tablelands of the Dividing Range. *Victoria*: along the coast and southern side of Dividing Range. *Tasmania*: widespread at low altitudes.

Also native to the highlands of New Guinea and Borneo (Ding Hou, 1957; Royen, 1979).

Ecology

Winter-growing evergreen perennial of habitats with the water table close to the surface



Map 12. Distribution of *Centrolepis fascicularis*.

throughout the year, from coastal swamps to alpine peat bogs. *Flowers* in November to February.

Notes

Resembles the annual species *C. pilosa* and *C. strigosa*; however, the lower seed production, with about three carpels per pseudanthium but often only one producing a seed, implies a *K*-strategy associated with the perennial habit.

Selected specimens examined (total 157)

WESTERN AUSTRALIA: Bramley, Margaret River district, 20.x.1951, *Royce 3821* (PERTH).

SOUTH AUSTRALIA: Boyles Swamp, Mylor, 19.i.1977, *Bates 2072* (AD); 4 km NE of Yundi, 20.xi.1976, *Bell 35* (AD); near Rocky River, Flinders Chase, 6.i.1966, *Eichler 18601* (AD); Mt Gambier Forest, 21.ii.1985, *Greenham 431* (AD).

QUEENSLAND: Stanthorpe, xii.1883, *Scortechini s.n.* (MEL).

NEW SOUTH WALES: Ulladulla, 1883, *Bauerlen s.n.* (MEL); Govetts Leap, Blackheath, 10.xii.1964, *Constable 5583* (NSW; MEL); South Coast, 36°06'S 149°32'E, 29.iii.1974, *Craven 2562* (CANB); Jennings - Boonoo Boonoo track, i.1956, *Gray s.n.* (CANB); South Coogee, 26.ix.1964, *Mair s.n.* (NSW).

VICTORIA: Portland Sanctuary Swamp, 11.ii.1950, *Beauglehole 39703* (MEL); St. Georges Plain, 37°38'S 149°03'E, 27.v.1980, *Cooke 285* (MEL); 10 miles NE of carlisle, Otway Ranges, 15.x.1960, *Muir 1800* (MEL); Grampians near Halls Gap, n.d., *Sharrad 506* (AD); Tidal River, Wilsons Promontory, 2.i.1965, *Specht 2908* (MELU); Belgrave, i.1933, *Willis s.n.* (MEL).

TASMANIA: Strahan, 22.i.1949, *Blake 18397* (HO); Birches Inlet Hut, 15.xi.1983, *Buchanan 1360* (AD, HO); King Island., 9.iv.1966, *Cameron s.n.* (HO); road to Hansons Mill, Snug Plains, 28.i.1960, *Jackson s.n.* (HO); Condominium Ck, Scotts Peak road, 4.1.1977, *Mason 13186* (HO); Killiecrankie bay, Flinders Island, 20.xi.1966, *Whinray 7* (HO).

13. **Centrolepis curta** D.A. Cooke, sp. nov.

Herba annua nana caespes rotundatos 2-4 cm diametro formans. *Radices* numerosi parce ramificantes. *Caulis* brevissimus ex axillis foliarum inferiorum ramificans. *Folia* tot basalia pseudospiraliter radiata vaginis membranaceis 1.5-3 mm longis c. 0.6 mm latis in laminis linearibus subapplanatis laxis 6-24 mm longis c. 0.3 mm latis transientibus, in vaginis et partibus proximalibus laminarum sparsim pilosa; apices foliorum acuti mucronulati. Folium summum ad cataphyllum subacutum hyalinum glabrum enervatum 2-2.5 mm longum reductum. *Scapus* absens. *Capitulum* sessilia vel subsessilia, conferta, cylindrica, c. 2 mm diametro, foliis persuperata. *Bracteae* primariae oppositae, ecarinatae, uninervatae, capitulum includentes; exteriora vagina membranacea 1.7-2.5 mm longa, sparsim pilosa, ciliolata, in lamina 0.8-3.2 mm longa transiente; interiora similis lamina 0.5-2 mm longa. *Pseudanthia* 4-6 bisexualia, unumquidque bracteis secundariis 2 anguste oblongis 1.7-2.2 mm longis truncatis eroso-fimbriatis hyalinis. *Stamen* unicum, gynophoro discretum, filamento 3-4 mm longo, anthera c. 1 mm longa ellipsoidea exserta. *Gynoecium* 4-10 carpidio in stylis c. 2 mm longis fere discretis papillis stigmatum simplicibus. *Semen* ovoideum, c. 0.4 mm longum; testa laeve, straminea.

Type: Blyxa Creek, Prince Regent River Reserve, 15°48'S 125°20'E, 19.viii.1974, *A.S. George 12423* (Holo: PERTH!).

Annual dwarf herb forming rounded tufts 2-4 cm diam. *Roots* numerous, sparsely branched. *Stem* branching from the lower axils to form internodes of negligible length. *Leaves* all basal, regularly radiating in a false spiral phyllotaxy throughout the tuft; sheath 1.5-3 mm long, c. 0.6 mm wide, membranous with hyaline margins, sparsely pilose, passing into a straight linear lamina 6-24 mm long, c. 0.3 mm wide, ± flattened, sparsely pilose near the base with hairs decreasing in length distally; apex acute, mucronulate. Uppermost leaf reduced to a subacute veinless glabrous hyaline cataphyll 2-2.5 mm long. *Scape* absent. *Head* sessile or terminal on internodes to 1 mm long, cylindric, c. 2 mm diam., crowded in the centre of the tuft and far exceeded by the leaves. *Primary bracts* opposite, rounded on the back, 1-veined, loosely enclosing the head; outer bract with a membranous sheath 1.7-2.5 mm long, sparsely pilose with ciliate margins, passing into a leaf-like lamina 0.8-3.2 mm long; inner bract similar but with a lamina 0.5-2 mm long. *Pseudanthia* 4-6, all bisexual. *Secondary bracts* 2 per pseudanthium, narrow-oblong, 1.7-2.2 mm long, truncate with erose-fimbriate apices, hyaline. *Stamen* free from gynophore; filament capillary, 3-4 mm long; anther ellipsoid, c. 1 mm long, exserted. *Gynoecium* of 4-10 carpels; styles free, c. 2 mm long, pale brown; stigmatic papillae simple, c. 0.03 mm. *Seed* ovoid, c. 0.4 mm long; testa smooth, stramineous. Fig. 14.

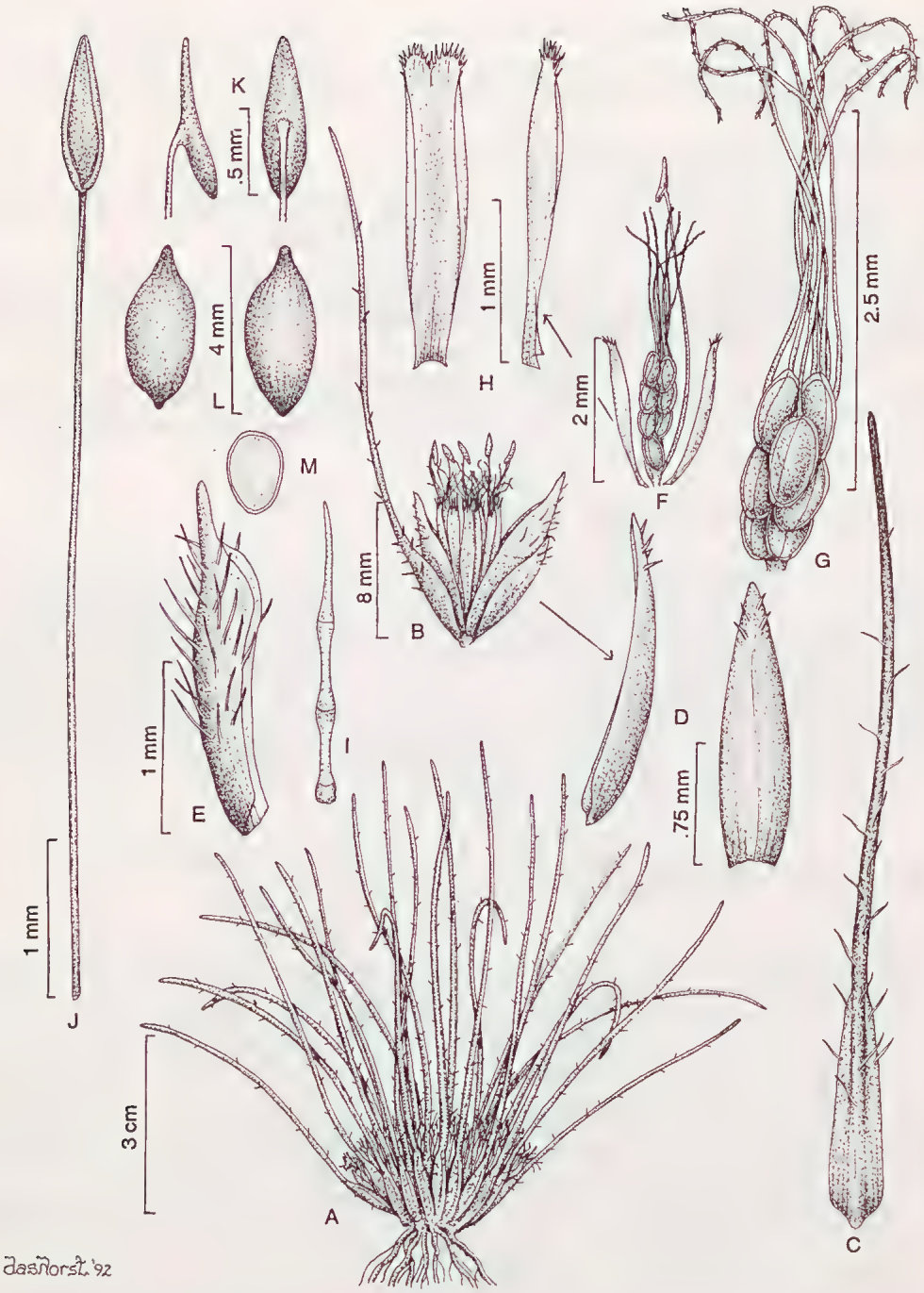
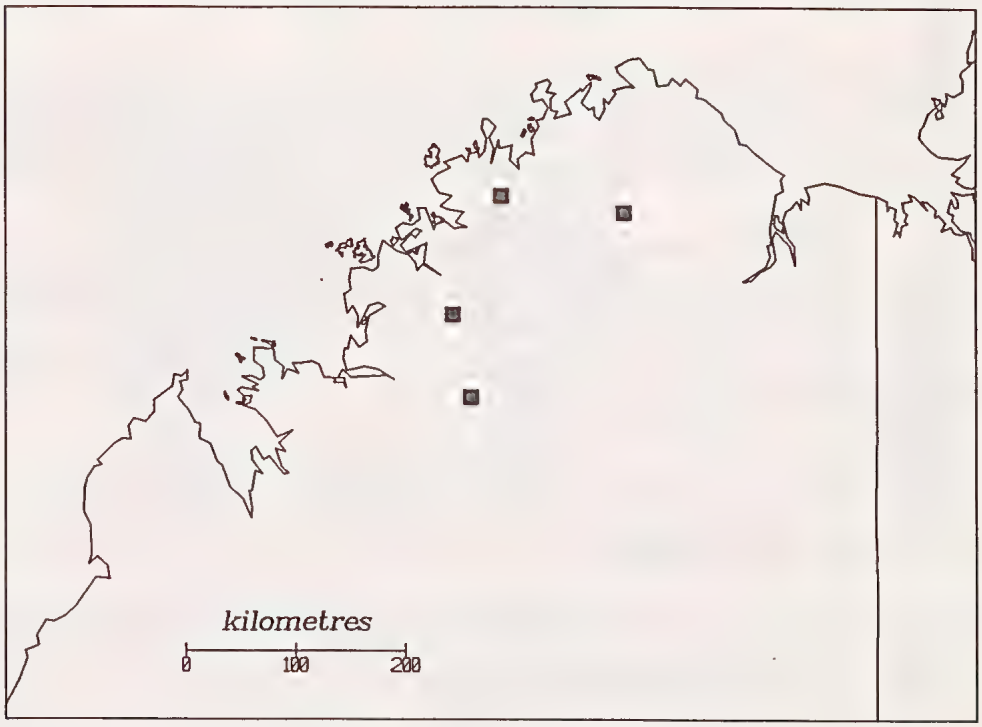


Fig. 14. *Centrolepis curta.* A, habit; B, head, leaf and cataphyll; C, leaf; D, cataphyll, two views; E, outer primary bract; F, pseudanthium with secondary bract; G, gynoecium; H, secondary bract, two views; I, hair off outer primary bract; J, stamen; K, anther, two lateral views; L, seed, two lateral views; M, seed, cross section view. (Based on *A.S. George 12423*: PERTH).

Distribution (Map 13)

Western Australia: endemic to the Kimberley District north of 17°S latitude, within the Gardner botanical district of Beard (1980).



Map 13. Distribution of *Centrolepis curta.*

Ecology

Occurs in open woodland and low grassland, in moist microhabitats such as seepage areas and alluvial flats. *Flowering* is recorded in May to August.

Notes

This species is placed with the *C. strigosa* group on the evidence of its multicellular hairs, radially arranged leaves, free styles and large secondary bracts but differs from them in its scapeless habit. It is readily distinguished from all other scapeless species by the presence of hairs on the leaves and primary bracts.

Etymology

Latin *curtus*, short; referring to the low stature of the plant due to its scapeless habit.

Specimens examined

WESTERN AUSTRALIA: ± 5 km W of Beverley Springs homestead, 11.viii.1974, *George 12233* (PERTH); above Carson Escarpment S of Coucal Gorge, Drysdale River National Park, ± 15°02'S 126°49'E, 16.viii.1975, *George 13911* (PERTH); Gauging station, Camp Creek c. 12 km SW of mining camp, Mitchell Plateau, 14°53'10"S 125°45'05"E, 3.v.1982, *Kenneally 8227* (PERTH).

14. **Centrolepis drummondiana** (Nees) Walp., Ann. Bot. Syst. 1:896 (1849) ut *C. drummondii*; F. Muell., Fragm. Phyt. Aust. 8:237 (1874); Benth., Fl. Austral. 7:206 (1878); J. Black, Fl. S. Aust. 1:102 (1922); Blackall & Grieve, West. Aust. Wildfl. 1:59 (1954); Cooke in Jessop & Toelken, Fl. S. Aust. 4:1826 (1986); Rye in Marchant et al., Fl. Perth Reg. 2:926 (1987).

Devauxia drummondiana Nees, Ann. Mag. Nat. Hist. ser. 1, 6:51 (1841), basionym.

Type: ad flumen cygnorum [W.A.], *Drummond s.n.* (Holo.: B n.v.; iso.: MEL 559507!, MEL 559508!). The holotype bears the annotations "Hb Lindley" and "Hb Nees".

Devauxia drummondii Nees in Lehm., Pl. Preiss. 2:70 (1846), sphalm. orthog., ut '*Desvauxia drummondii*'; Steudel, Syn. Pl. Glum. 2:267 (1855).

Devauxia brevifolia Nees in Lehm., Pl. Preiss. 2:70 (1846) ut '*Desvauxia*'; Steudel, Syn. Pl. Glum. 2:267 (1855).

Centrolepis brevifolia (Nees) Walp., Ann. Bot. 1:896 (1849); Hieron., Abh. Naturf. Ges. Halle 12:212 (1873).

Type: summi montis Clarence, Plantagenet [W.A.], Sept. 1840, *Preiss 1749*. (Holo.: B n.v.; iso.: MEL 536055!). The holotype bears the annotation "Hb Nees".

Devauxia urvillei Steudel, Syn. Pl. Glum. 2:267 (1855); *Centrolepis urvillei* (Steudel)Hieron., Abh. Naturf. Ges. Halle 12:214 (1873).

Type: Portum Georgii, N. Holl.[W.A.], *Urville* (Holo.: P photo.!).

Centrolepis pulchra Hieron., Abh. Naturf. Ges. Halle 12:213 (1873).

Type: Western Australia, *Drummond 930* (Holo.: B n.v.; iso.: MEL 1513045!). Hieronymus cited the holotype from the Vienna Herbarium (W), but it was later removed to Berlin-Dahlem; the sheet is annotated "Hb Hieronymus".

Tufted annual 2-11 cm high, softly herbaceous. *Roots* numerous, hardly branched. *Stem* very short, repeatedly branching from the lower leaf axils to form internodes of negligible length. *Leaves* numerous, basal, very obscurely distichous, lax; sheath 2-5 mm long, membranous with hyaline margins sometimes bearing scattered crisped hairs, passing into a straight linear lamina 4-30 mm long, c. 0.4 mm wide, glabrous or microscopically papillate; apex acute, mucronate. Uppermost leaf reduced to an obtuse veinless hyaline cataphyll 3-7 mm long, sometimes with a few hairs at apex. *Scape* terete, filiform, 1.5-10 mm long, glabrous. *Head* terete, narrowly ovoid to pyriform, 1.6-2.5 mm wide. *Primary bracts* subopposite, separated by an internode to 2 mm, rounded on the back, 3-5-veined, glabrous or sparsely papillate, tightly sheathing; outer bract with a sheath 2.5-6 mm long, herbaceous with entire scarious margins, passing abruptly into a filiform lamina 0.5-3.5 mm long; inner bract, slightly smaller. *Secondary bracts* 2 per pseudanthium, 2-4 mm long, acute, erose, hyaline. *Pseudanthia* 4-12, bisexual, 4-6 in each bract or all in the inner bract. *Stamen* free or very shortly adnate to gynophore; filament capillary, 3-4 mm long; anther ovoid-ellipsoid, 1-1.8 mm long. *Gynoecium* of 4-7 carpels; styles 2-3 mm long, connate for half their length, pale brown; papillae simple, c. 0.03 mm. *Seed* ovoid, c. 0.5 mm long; testa smooth, stramineous. Fig. 15.

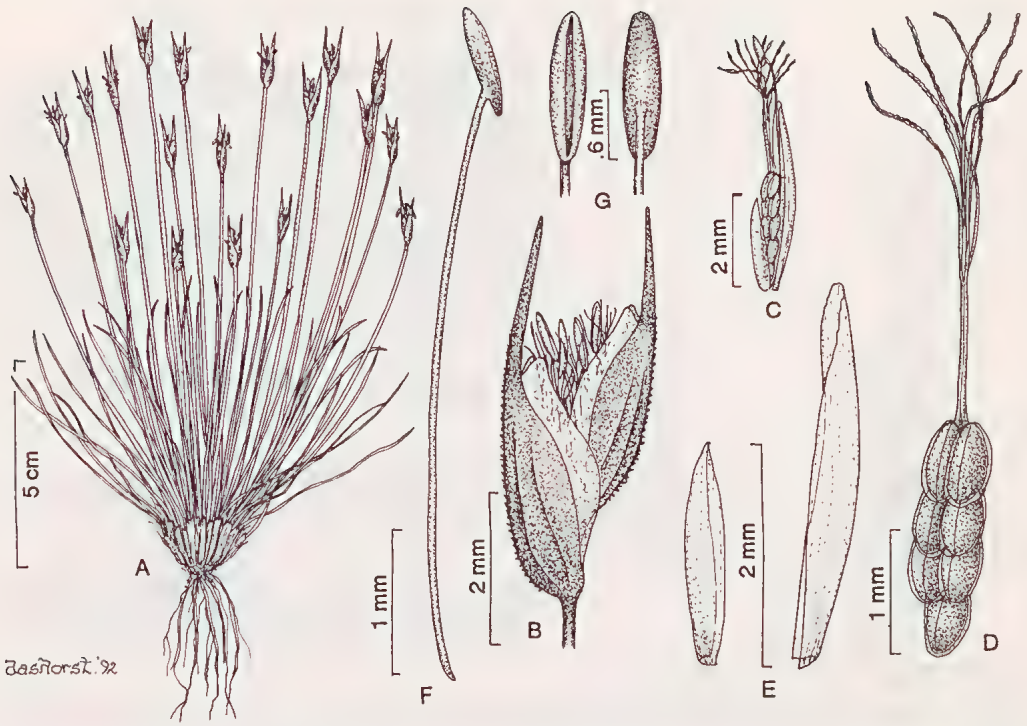


Fig. 15. *Centrolepis drummondiana*. A, habit; B, head; C, pseudanthium with secondary bracts; D, gynoecium; E, secondary bracts; F, stamen; G, anthers, two views. (Based on *J.B. Cleland* AD 97226057).

Distribution (Map 14)

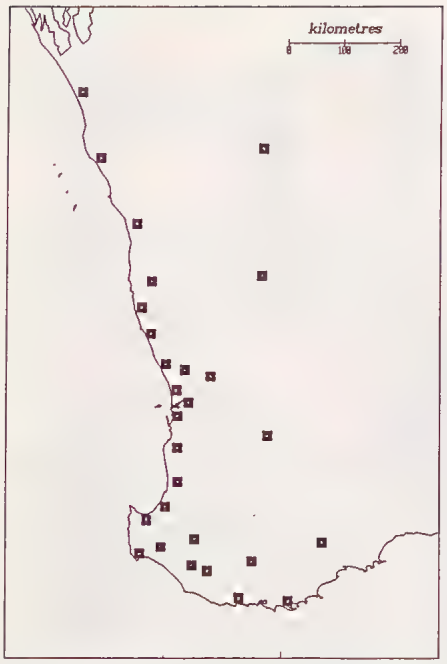
Western Australia: widespread and common from Shark Bay south and east to the Porongorups, in the Irwin, Darling and Avon botanical districts. *South Australia*: recorded by one collection from Wooltana Station in the Flinders Ranges, where it is possibly a casual introduction.

Ecology

Winter annual, *flowering* in September to November. Grows in a wide variety of habitats including sand heath, lithoseral moss beds and swampy sites on clay soils.

Notes

Nees (1847) published the name *Devauxia drummondii* (genitive of the surname 'Drummond'), repeating verbatim his 1841 description of *D. drummondiana* (adjective formed from the same surname) and citing both the type of that name and another specimen, *Preiss 1809*. The spelling *drummondii* has been taken up by subsequent authors including Walpers (1849), who transferred this species to *Centrolepis* but cited Nees (1841) as the source of the epithet. According to the Code, the incorrect use of such terminations as -ii and -ianus is treated as an orthographic error; therefore, the original spelling of *drummondiana* is here upheld.



Map. 14. Distribution of *Centrolepis drummondiana.*

Selected specimens examined (total 50)

WESTERN AUSTRALIA: Augusta, 27.x.1983, *Corrick 8950* (AD; MEL); 29 miles [47 km] W of Mt Magnet, 11.ix.1966, *George 7980* (PERTH); summit of Mt Hassell, Stirling Range, 18.x.1977, *Keighery 1220* (PERTH); Bayswater, 29.xi.1906, *Morrison s.n.* (PERTH); Cowallelup Reserve, 23.ix.1978, *Newbey 5128* (PERTH); Wongan Hills, 13.ix.1947, *Royce 2180* (PERTH); Daradup, 22.x.1948, *Royce 2921* (PERTH); Nancys Peak, Porongorup Range, 29.x.1959, *Royce 6125* (PERTH); Brand Hwy 30 km S of Eneabba, 12.x.1978, *Spencer 5* (MEL); Nambung National Park, 12.x.1978, *Spencer 12* (MEL); Peak Charles - Lake King road, 28.xi.1973, *Weston 9023* (PERTH).

SOUTH AUSTRALIA: Wooltana Station, xii.1920, *White s.n.* (AD 97516023).

15. **Centrolepis mutica** (R. Br.)Hieron., Abh. Naturf. Ges. Halle 12:211 (1873); Benth., Fl. Austral. 7:204 (1878).

Alepyrum muticum R. Br., Prodr. 253 (1810), basionym; Roemer & Schultes, Syst. Nat. 1:44 (1817); Kunth, Enum. Pl. 3:488 (1841); Steudel, Syn. Pl. Glum. 2:266 (1855).

Type: banks of Oyster Harbour, King Georges Sound [W.A.], Dec.1801, *Brown* sub Bennett No. 5836 (Holo.: BM!).

Slender erect annual 3-7 cm high, rigidly herbaceous, becoming purplish after flowering. *Roots* numerous, hardly branched. *Stem* densely branching, forming internodes of negligible length. *Leaves* few, basal, obscurely distichous, lax, glabrous; sheath hyaline-scarious, 2-4 mm long, passing into a linear subterete lamina 4-11 mm long, c. 0.3 mm wide; apex obtuse, emucronate. Uppermost 1 or 2 leaves reduced to obtuse veinless hyaline-scarious cataphylls 2-4 mm long. *Scape* capillary, 1-6 cm long, terete, glabrous. *Head* terete, ovoid-conic, 1-2 mm wide. *Primary bracts* subopposite, rounded on the back, 3-veined, glabrous, tightly enclosing the head; outer bract with a sheath c. 3 mm long, herbaceous with regularly ciliolate narrow hyaline margins, acuminate or produced into a straight foliar point to 1 mm long; inner bract similar but with entire margins, the acute apex never produced into a foliar point. *Secondary bracts* absent. *Pseudanthia* 3-6, bisexual. *Stamen* shortly adnate to the gynophore; filament capillary, 2.5-3.5 mm long; anther ellipsoid, c. 0.5 mm long. *Gynoecium* of 5-8 carpels; styles c. 2 mm long, connate at the base, brown; stigmatic papillae simple, c. 0.02 mm long. Seed ovoid, c. 0.5 mm long; testa smooth, stramineous. Fig. 16.

Distribution (Map 15)

Western Australia: scattered in the Darling botanical district of the south-west from Perth to Albany between the 700 and 1100 mm annual isohyets.

Ecology

Winter annual of sand heath and woodland on low-nutrient soils, *flowering* in November.

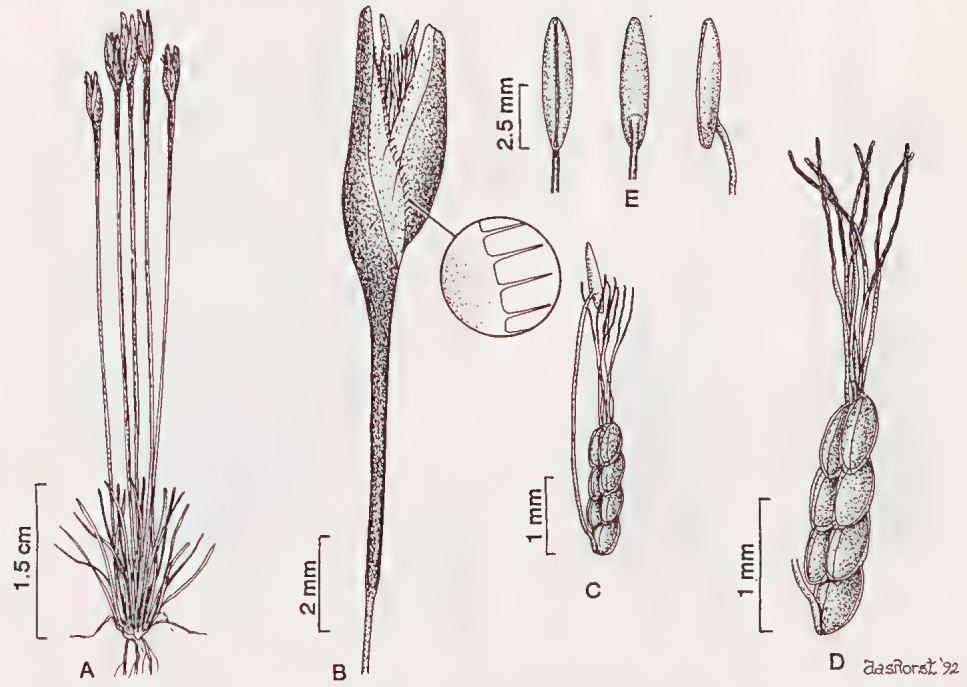


Fig. 16. *Centrolepis mutica.* A, habit; B, head; C, pseudanthium; D, gynoecium; E, anther, 3 views. (Based on *A. Morrison* PERTH 02039222).

Notes

C. mutica closely resembles *C. drummondiana*, but with a more gracile habit and fewer pseudanthia associated with a niche further from the ruderal strategy. In this it parallels the relationship between *C. alepyroides* and *C. aristata* in the same region, and also shows convergence with *C. polygyna* in its habit and loss of secondary bracts.

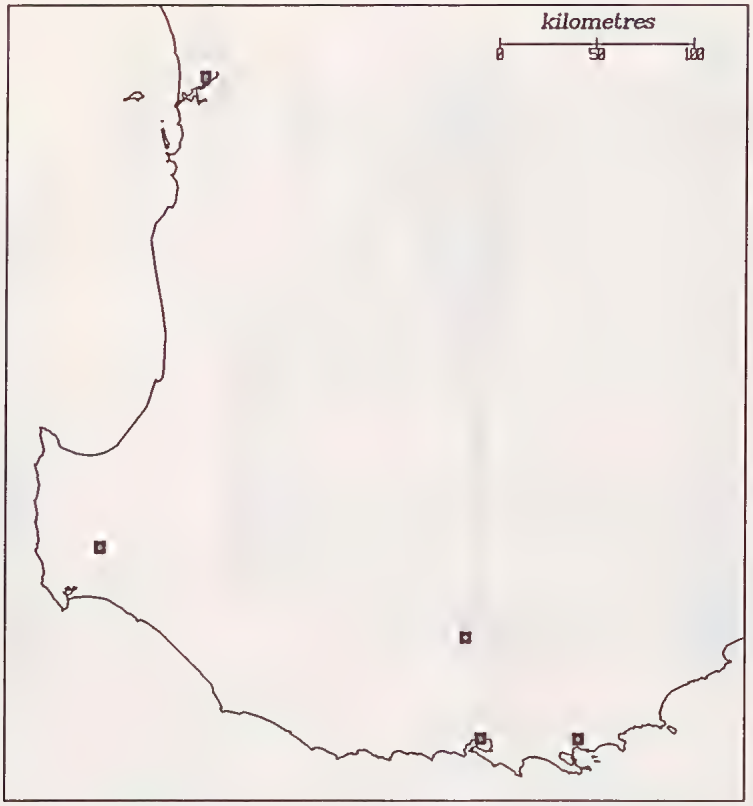
This name has been widely misapplied, all material of *C. mutica* in Australian herbaria having previously been referred to the commoner *C. drummondiana*. Mentions of *C. mutica* in local literature (eg. Blackall & Grieve, 1954) cannot be referred to any species with certainty.

Specimens examined

WESTERN AUSTRALIA: Bayswater, 14.xii.1904, *Morrison s.n.* (PERTH); Bayswater, 29.xi.1906, *Morrison s.n.* (PERTH); Blackwood River, xi.1877, *Mueller s.n.* (MEL); between Frankland and Mt Barker, 12.xii.1974, *Pullen 9998B* (CANB); n. loc., 1944, *Royce s.n.* (PERTH); c. 1 mile E of Denmark/Albany junction, 21.xi.1980, *Webster 643* (PERTH).

16. **Centrolepis eremica** D.A. Cooke in Jessop & Toelken, Fl. S. Aust. 4:1826 (1986).

Type: Everard Range, S. Aust., ix.1968, *A.G. Spooner 73* (Holo.: AD 96845116!).



Map 15. Distribution of *Centrolepis mutica*.

Annual 2-4 cm high forming dense hemispherical tufts to 6 cm diam., rigidly herbaceous, never purplish. *Roots* numerous, hardly branched. *Stem* very short, repeatedly branching from the lower axils, forming internodes of negligible length. *Leaves* few to many, not distichous, glabrous; sheath 1-5 mm long, scarious, passing into a recurved terete linear lamina 5-12 mm long, 0.5-0.8 mm wide; apex obtuse, emucronate. Uppermost leaf reduced to an obtuse veinless glabrous scarious cataphyll c. 2 mm long. Scape terete, 1-3 cm long, glabrous. Head ovoid-conic, 1-2 mm wide. Primary bracts opposite, rounded on the back, glabrous, closely sheathing; outer bract with a brown cartilaginous 1-veined sheath 2-3.5 mm long passing abruptly into a lamina 2-8 mm long; inner bract 1.8-3 mm long, acute, brown cartilaginous, lacking a lamina. *Secondary bracts* absent. *Pseudanthia* 4-10, bisexual or a minority lacking the stamen. *Stamen* free; filament capillary, 2-3 mm long; anther ovoid, 1-1.2 mm long. *Gynoecium* of 6-20 carpels; styles c. 2 mm long, connate at the base, pale brown; stigmatic papillae simple, c. 0.03 mm long. *Seed* ovoid, c. 0.5 mm long; testa smooth, stramineous. Fig. 17.

Distribution (Map 16)

Western Australia: Austin, Helms and Giles botanical districts of the Eremaean province. *Northern Territory*: widespread south of 20°S. *South Australia*: extending south to northern Eyre Peninsula and the plains around Lake Torrens but absent from the Flinders Ranges. *New South Wales*: localised in the north far western plains region.

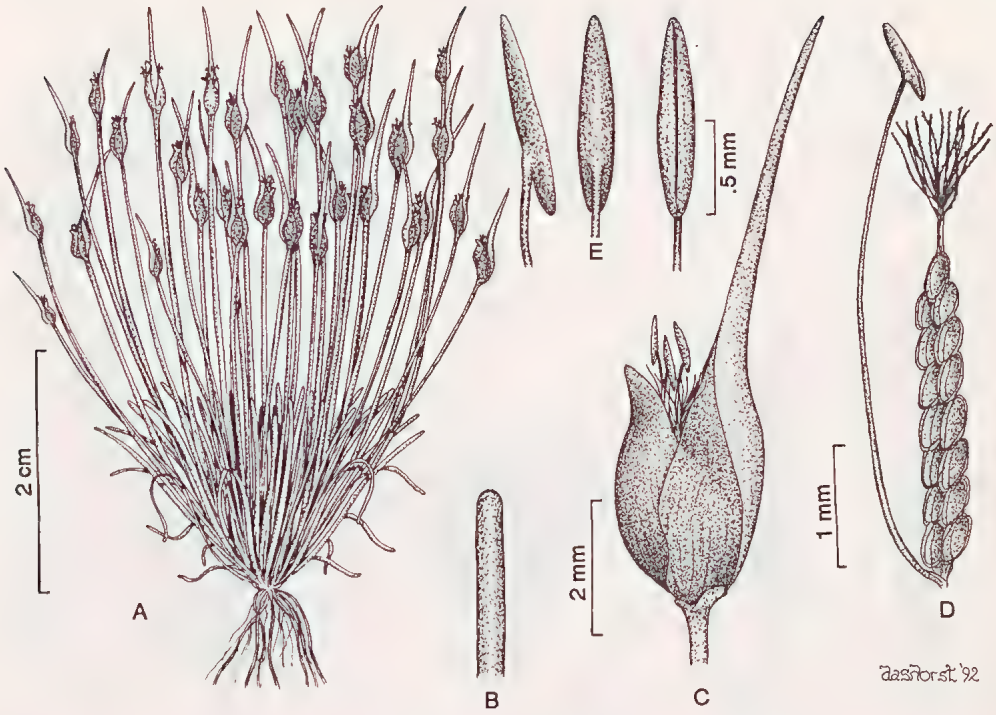


Fig. 17. *Centrolepis eremica.* A, habit; B, leaf apex; C, head; D, pseudanthium; E, anther, three views. (Based on *A.G. Spooner 73*: AD).

Ecology

Annual, growing during the wet season. Associated with temporary water on the margins of creeks, lakes, claypans or large boulders producing runoff. *Flowers* in July to September.

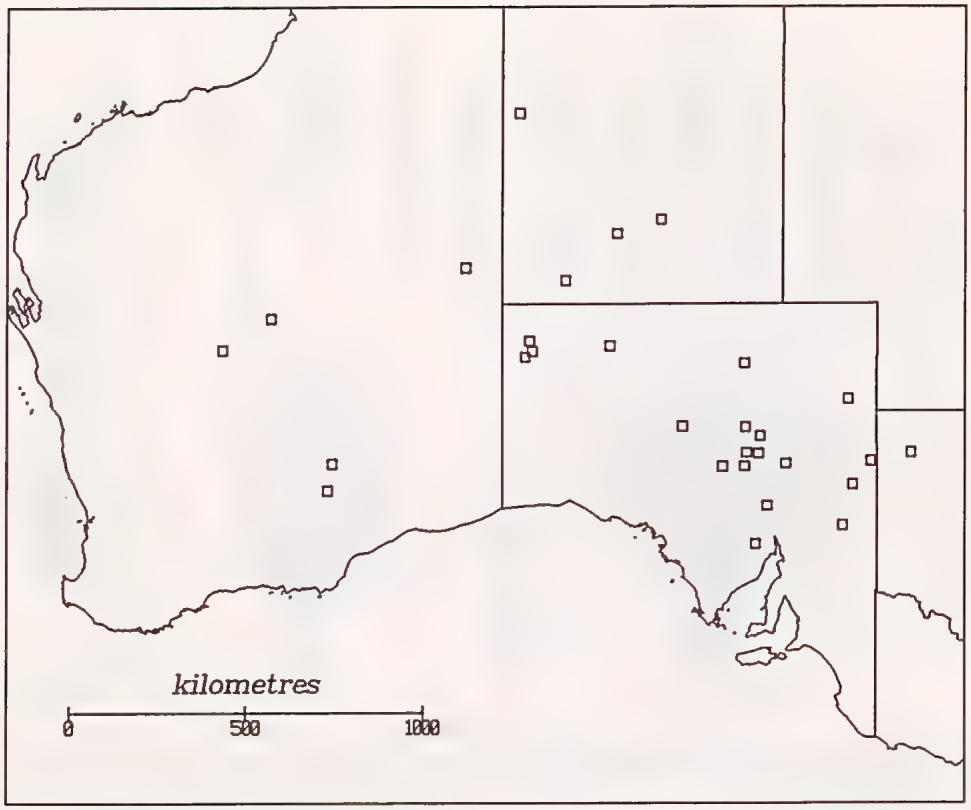
Notes

Close to *C. polygyna* from which it is separated by the broader ovoid-conic heads containing more numerous pseudanthia with free or absent stamens. These differences remain distinct in regions such as northern Eyre Peninsula where the two species are parapatric. The denser habit of *C. eremica* is a consequence of the production of successive inflorescences after the first have set seed. These two species form, with *C. cephaloformis* and *C. humillima*, a group characterised by one-veined and very unequally developed primary bracts and a rigid "sclerophyllous" texture due to the development of sclereid fibres in the leaves and bracts.

Selected specimens examined (total 38)

WESTERN AUSTRALIA: Beru Pool, Yelma Station, 5.ix.1973, *Chinnock 753* (AD; PERTH); Queen Victoria Spring, 21.ix.1963, *George 5861* (PERTH); Wallaroo Rock 72 km NW Coolgardie, 17.ix.1981, *Newbey 8936* (PERTH); Yeelirrie Station, 1982, *Trudgen s.n.* (MEL).

NORTHERN TERRITORY: Ayers Rock, 14.viii.1959, *Jackson 114* (AD); S of Mongrel Downs Station, 5.viii.1976, *Latz 6552* (NT, PERTH); Conlins Lagoon, vii.1894, *Tate s.n.* (AD); Palm Creek, vii.1894, *Tate s.n.* (AD).



Map 16. Distribution of *Centrolepis eremica.*

SOUTH AUSTRALIA: Christmas Water, Simpson Desert, 1961, *Ashton s.n.* (AD); South Corunna Hill, 8.ix.1974, *Chinnock 2014A* (AD); Mt Carmeena, Everard Ra., 15.ix.1963, *Eichler 17532* (AD); Coongie Lakes, 28.ii.1987, *Reid 438* (AD 98715308); SE arm of Lake Frome, 24.viii.1971, *Weber 2114* (AD).

NEW SOUTH WALES: Cobham Lake, n.d., *Bäuerlen 271* (MEL).

17. **Centrolepis polygyna** (R. Br.) Hieron., Abh. Naturf. Ges. Halle 12:210 (1873); F. Muell., Fragm. Phyt. Aust. 8:237 (1874); Benth., Fl. Austral. 7:203 (1878); Bailey, Queensl. Fl. 6:1719 (1902); Rodway, Tasm. Fl. 231 (1903); J. Black, Fl. S. Aust. 1:10 (1922); Ewart, Fl. Vict. 261 (1931); J.H. Willis, Handb. Pl. Vict. 1:278 (1962); Cooke in Jessop & Toelken, Fl. S. Aust. 4:1827 (1986).

Alepyrum polygynum R. Br., Prodr. 253 (1810), basionym.; Roemer & Schultes, Syst. Nat. 1:44 (1817); Desv., Ann. Sci. Nat. (Paris) 13:42 (1828); Nees in Lehm., Pl. Preiss. 2:71 (1846); J.D. Hook., Fl. Tasman. 2:78 (1860).

Type: banks of Oyster Harbour, King Georges Sound [W.A.], xii.1801, *Brown* sub Bennett No.5834 (Holo.: BM!).

Alepyrum polygamum Kunth, Enum. Pl. 3:488 (1841); Steudel, Syn. Pl. Glum. 2:266 (1855), sphalm. orthog.

Alepyrum pumilio R. Br., Prodr. 253 (1810); Roemer & Schultes, Syst. Nat. 1:44 (1817); Desv., Ann. Sci. Nat. (Paris) 13:42 (1828); Kunth., Enum. Pl. 3:488 (1841); Steudel, Syn. Pl. Glum. 2:266 (1855).

Type: Oyster Harbour, King Georges Sound [W.A.], xii.1801, *Brown* sub Bennett No. 5835 (Holo.: BM!).

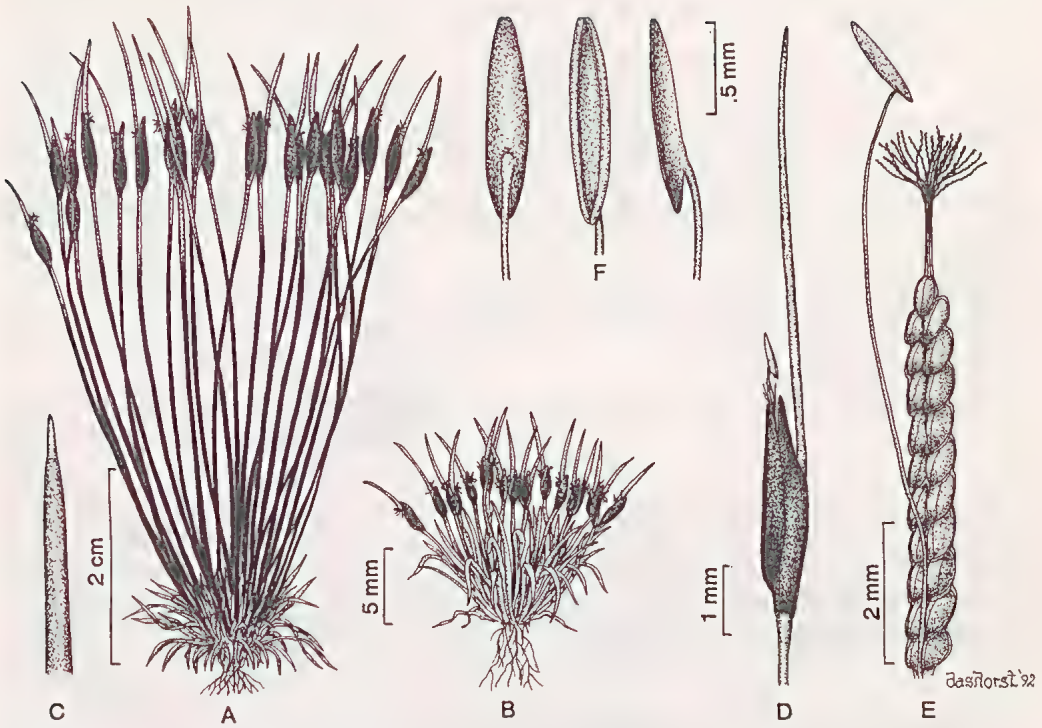


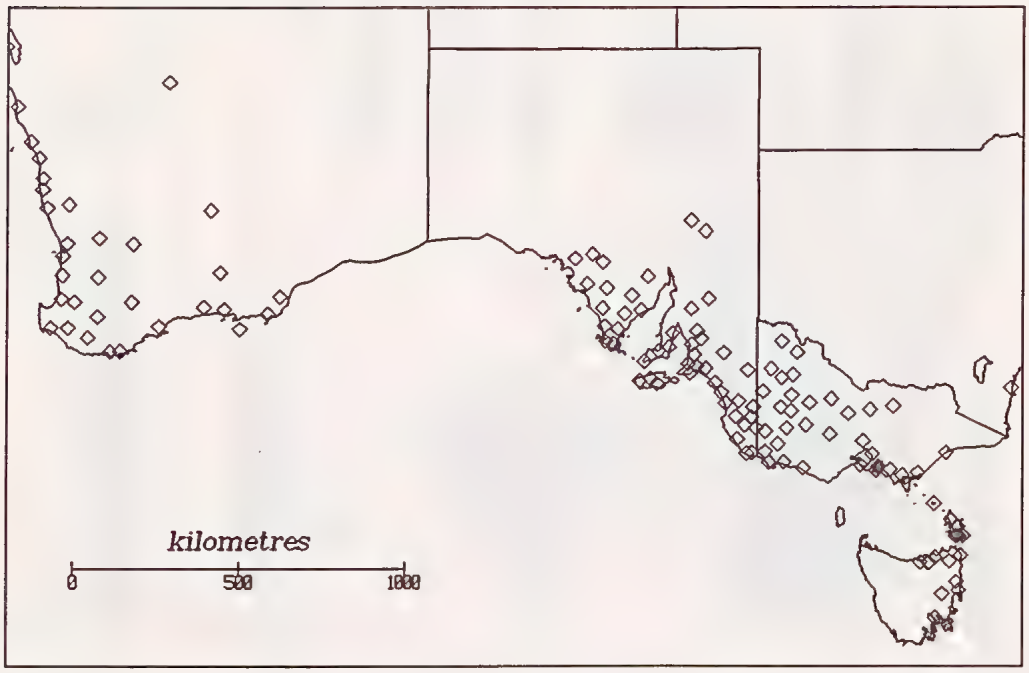
Fig. 18. *Centrolepis polygyna.* A, habit; B, habit; C, leaf apex; D, head; E, pseudanthium; F, anther, 3 views. (Based on *D.A. Cooke 403*: AD).

Tufted annual 1-7 cm high, rigidly herbaceous, becoming purplish after flowering. *Roots* numerous, hardly branched. *Stem* repeatedly branching from the lower axils, forming internodes of negligible length. *Leaves* few to many, not distichous, glabrous; sheath 1-5 mm long, scarious-hyaline, passing into a recurved or erect terete linear lamina 3-12 mm long, 0.5-0.8 mm wide; apex acute with a hyaline mucro or rarely obtuse. Uppermost leaf reduced to an obtuse veinless glabrous scarious cataphyll 1.5-3.5 mm long. *Scape* terete, up to 6 cm long, capillary, glabrous; rarely reduced and the head subsessile. *Head* cylindric or slightly compressed laterally, 0.7-1 mm wide. *Primary bracts* opposite, rounded on the back, glabrous, closely sheathing; outer bract with a brown cartilaginous 1-veined sheath 2-4.2 mm long passing abruptly into a ± recurved lamina 3-20 mm long; inner bract 2-4 mm long, acute, brown cartilaginous, lacking a lamina. *Secondary bracts* absent or rarely 1, acute, up to 1.8 mm long, brown, scarious. *Pseudanthia* 1-3, bisexual. *Stamen* adnate to the gynophore for 0.5-1 mm; filament capillary, 2.2-4.8 mm long; anther ellipsoid, 0.5-1.5 mm long. *Gynoecium* of 6-30 carpels; styles 1.4-2.6 mm long, connate at the base, pale brown; stigmatic papillae simple, c. 0.03 mm long. *Seed* ovoid, 0.5-0.8 mm long; testa smooth, stramineous. Fig. 18.

Distribution (Map 17)

Western Australia: widespread in the Irwin, Avon, Darling, Roe, Eyre and Coolgardie botanical districts. *South Australia*: widespread in southern areas, extending to Eyre Peninsula and the Flinders Ranges. *New South Wales*: occasional in the Central and Southern Western Slopes subdivisions. *Victoria*: widespread in the western half of the State; in the east infrequent on the coast and northern slopes of the Dividing Range. *Tasmania*: north and east coasts and the islands of Bass Strait.

Records from Central Australia (Tate, 1896; Jessop, 1981) are all referable to *C. eremica*.



Map 17. Distribution of *Centrolepis polygyna*.

Ecology

Winter annual of woodland, open forest, heath, scrub, moss beds, lake margins and mallee on sands and other infertile soils, where often growing with other *Centrolepis* spp. such as *C. strigosa*. *Flowers* in July to November.

Notes

C. polygyna is a variable species comprising many biotypes loosely associated with particular regions and habitats. For example, material from the Victorian mallee with two pseudanthia per head and a compact habit superficially resembling depauperate *C. eremica* was given the manuscript name var. *biflorum* by H.B. Williamson. Large, darkly pigmented plants with 2-3 pseudanthia per head are typical of south-western Victoria and the jarrah forests of Western Australia. Reduced states from Victoria and Tasmania resemble *C. cephaloformis* in their sessile heads (Cooke, 1980). An analysis of the variation in size, leaf apex, degree of purplish anthocyanin pigmentation, pseudanthia number, presence/absence of scape and presence/absence of a secondary bract showed no clear correlation among these characters, and recognition of infraspecific taxa is not justified.

Selected specimens examined (total 236)

WESTERN AUSTRALIA: Mt Chudalup, 9.x.1966, *Bennett 1603* (PERTH); Pallarup Rocks, 13.x.1960, *George 1568* (PERTH); Nambung National Park, 12.x.1978, *Spencer 15* (MEL); Tutanning Reserve, 16.xi.1965, *Wilson 3923* (PERTH).

SOUTH AUSTRALIA: Pondalowie, Innes National Park, 12.x.1974, *Alcock 4902* (AD); Granite Hill, 28.viii.1983, *Bates 3228* (AD); West Bay, Flinders Chase, 15.xi.1958, *Eichler 15515* (AD); Rowland Flat, 30.x.1978, *Keane 145* (AD).

NEW SOUTH WALES: Hastings River, n.d., *Beckler s.n.* (MEL).

VICTORIA: Mt Arapiles, 23.xi.1964, *Beauglehole 15891* (MEL); Kiata Lowan Sanctuary, 3.xi.1978, *Cooke 209* (MEL); Wartook, 5.xi.1978, *Cooke 253* (MEL); Quail Island, 22.xi.1952, *Melville 2085* (MEL).

TASMANIA: Bridport, 10.xi.1952, *Curtis s.n.* (HO); Moulting Lagoon, 7 miles NW of Coles Bay, 14.x.1967, *Hemsley 6255* (HO); Pot Boil Lagoon, Flinders Island, 15.i.1977, *Whinray 1529* (AD).

18. **Centrolepis humillima** F. Muell. ex Benth., Fl. Austral. 7:203 (1878); Diels & Pritzel, Bot. Jahrb. Syst. 35:95 (1904); Blackall & Grieve, West. Aust. Wildfl. 1:59 (1954); Cooke, Muelleria 4:270 (1980).

Type: Salt lagoons north of Stirling Range [W.A.], x.1867, *Mueller s.n.* (Holo.: K, n.v.; iso.: MEL 536059!, MEL 536060!).

Minute densely tufted annual, 4-10 mm high, coriaceous, forming dense colonies. *Roots* numerous, sparsely branched. *Stem* repeatedly branching from the lower axils to form internodes less than 0.3 mm long. *Leaves* few, obscurely distichous, glabrous; sheath brown, scarious, 0.8-2 mm long, passing into a rigid recurved broad-linear lamina 2-8 mm long, 0.5-1 mm wide, keeled, conduplicate towards the base; apex obtuse to acute, emucronate. Uppermost leaf reduced to an acute veinless scarious cataphyll. *Scape* absent. *Head* sessile or terminating internodes less than 0.4 mm long, laterally compressed, subcylindric, 0.5-1 mm wide. *Primary bracts* subopposite, glabrous, 1-veined, tightly enclosing the head; outer bract with a dark brown, strongly keeled, indurated sheath 1.5-3.5 mm long passing abruptly into a leaf-like lamina 2-5 mm long; inner bract 1-2.2 mm long, scarious to indurated with hyaline margins, conduplicate, the base exposed and often swollen, the apex acute and enclosed by the outer bract. *Secondary bracts* absent. *Pseudanthium* 1, bisexual, in the axil of the outer bract. *Stamen* free; filament capillary, 1.5-3.5 mm long; anther ellipsoid, 0.6-1.2 mm long. *Gynoecium* of (1)-3-7 carpels; styles 1.5-2.5 mm long, connate for less than half their length, pale brown. *Seed* ovoid, c. 0.5 mm long; testa regularly pusticulate, pale brown to white. Fig. 19.

Distribution (Map 18)

Western Australia: scattered in the Avon, Darling, Roe and Eyre botanical districts of the south-west between the 300 and 1000 mm annual isohyets.

Ecology

Winter annual of seral communities with sparse vegetation cover, often subject to water stress or low fertility, such as lithoseral moss beds and the margins of clay pans. *Flowers* in September to December.

Selected specimens examined (total 16)

WESTERN AUSTRALIA: 18 km E of Piawanning, 26.viii.1965, *Beauglehole 12254* (MEL); Natural Bridge, Albany, 11.ix.1965, *Beauglehole 12705* (MEL); Neridup, 21.ix.1968, *Eichler 19912* (AD; PERTH); Martin Creek, 7.ix.1971, *Eichler 21077A* (AD); Eyre Hwy 12.5 km SSE Salmon Gums, 12.xi.1971, *Eichler 21245* (AD); Martin Creek, 34°04'S 119°27'E, 7.ix.1971, *George 10937* (PERTH); Spring Creek, 3.x.1986, *Newbey s.n.* (PERTH);

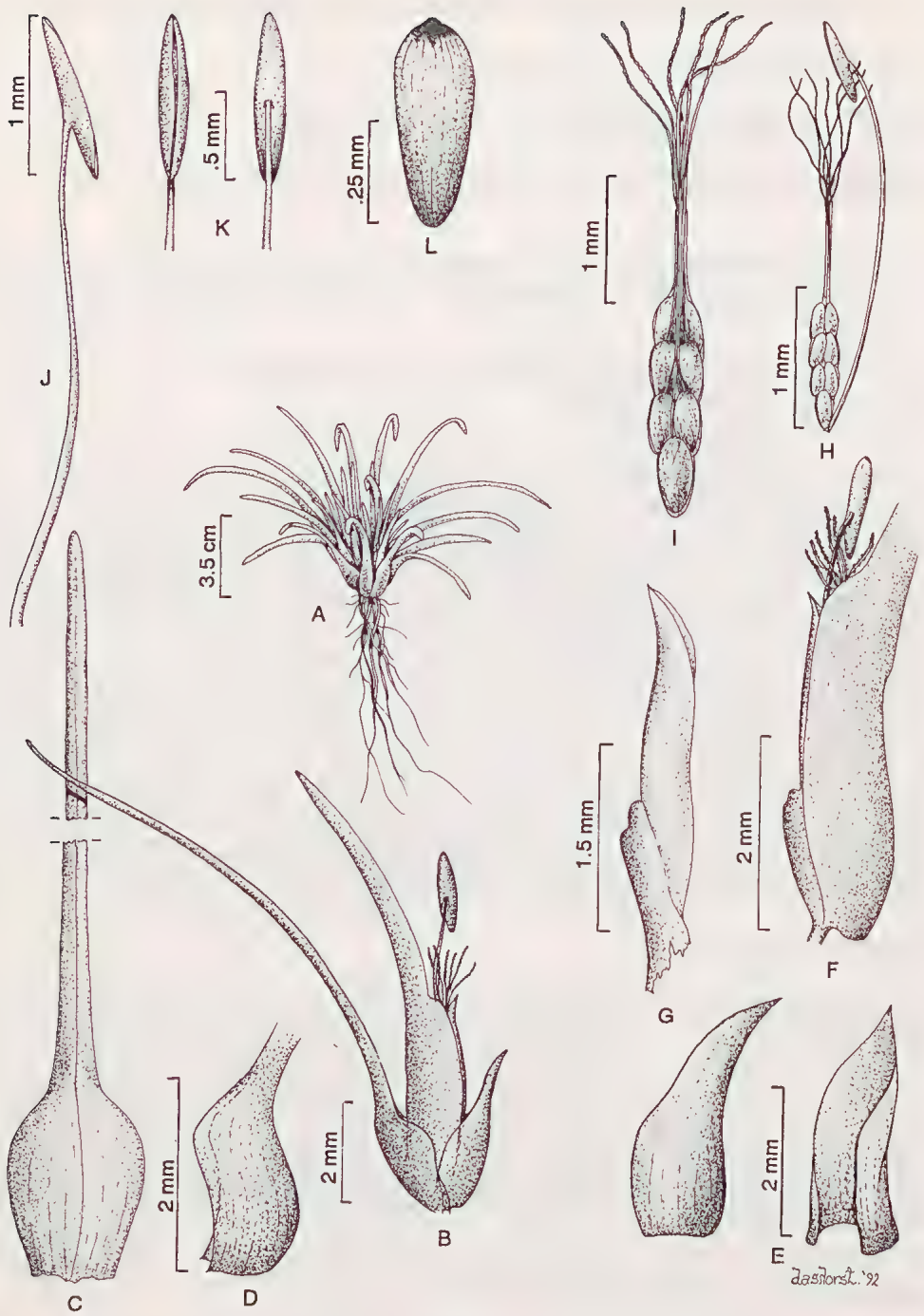
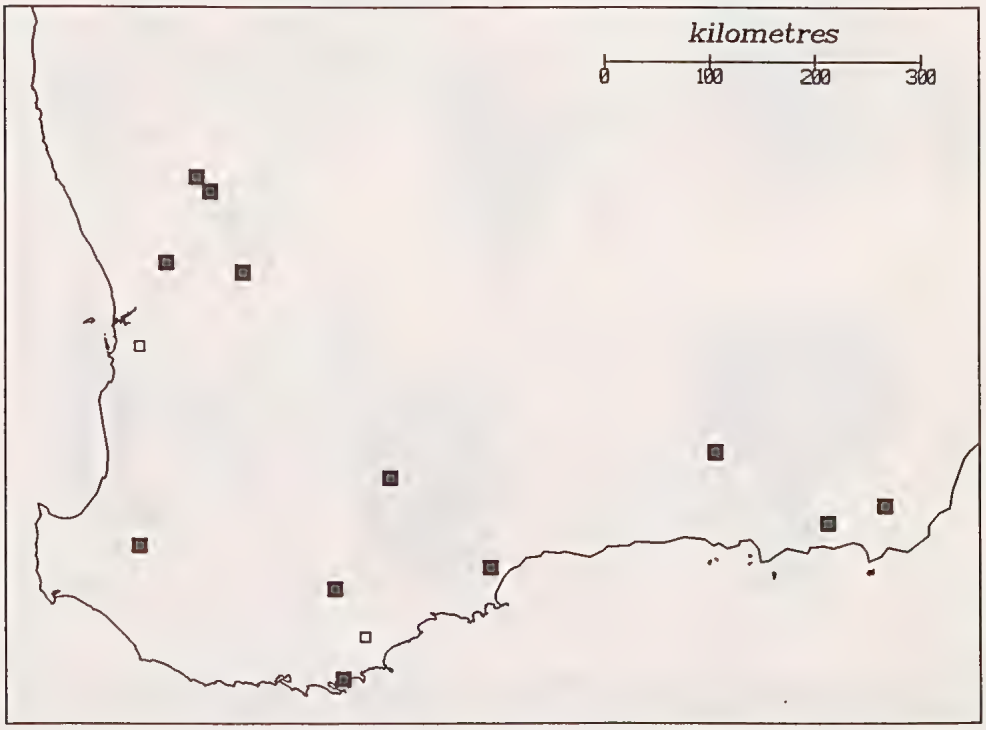


Fig. 19. *Centrolepis humillima.* A, habit; B, head, leaf and cataphyll; C, leaf; D, base of leaf, lateral view; E, cataphyll, two views; F, head; G, inner primary bract; H, pseudanthium; I, gynoecium; J, stamen; K, anther, two views; L, seed. (Based on *Hj. Eichler 21245*: AD).

Balladonia Road, Cape Arid N.P., 5.xii.1971, *Royce 10153* (PERTH); Wongan Hills, 17.ix.1963, *Willis s.n.* (MEL); Lake Grace road, 28 km N of Pingrup, 12.x.1979, *K. Wilson 2767* (NSW); Mortlock R. flats 4 km E of Meckering, 11.viii.1982, *P. Wilson 11839* (MEL; PERTH).



Map 18. Distribution of *Centrolepis humillima* ■ and *C. caespitosa* □.

19. **Centrolepis cephaloformis** F.M. Reader, Vict. Naturalist 19:97 (1902); Ewart, Fl. Vict. 260 (1931); J.H. Willis, Handb. Pl. Vict. 1:278 (1962); Cooke, Muelleria 4:267 (1980); Cooke, Fl. S. Aust. 4:1826 (1986).

Type: Sandy desert, Lowan [Vic.], 1892, *F.M. Reader s.n.* (Lecto.: MEL 536054, pro parte!; syn.: MEL 536054, pro parte!; MELU 11831!).

Dwarf annual 4-10 mm high, rigidly herbaceous, forming compact rounded tufts 4-32 mm diam. *Roots* numerous, hardly branched. *Stem* repeatedly branching from the lower axils to form internodes less than 1 mm long. Leaves few, not distichous, glabrous; sheath 1-2.5 mm long, scarious, passing into a ± recurved subulate lamina 2-6 mm long, 0.5-0.8 mm wide; apex acute with a hyaline mucro. Uppermost leaf reduced to a cataphyll. *Scape* absent or represented by an internode to 3 mm long. *Head* ovoid-conic, 1-1.7 mm wide, 2-3 mm long. *Primary bracts* opposite, keeled, glabrous, closely sheathing; outer bract with a scarious, stramineous, 1-veined sheath 2-3 mm long passing abruptly into a lamina 2-4.5 mm long; inner bract 2-3 mm long, acute or apiculate, scarious, lacking a lamina. *Secondary bracts* absent. *Pseudanthia* 1-3, bisexual or one lacking the stamen. *Stamen* free; filament capillary, 2-4 mm long; anther ovoid-ellipsoid, 0.5-1.4 mm long. *Gynoecium* of 4-10 carpels; styles 1-2 mm long, connate for half their length, pale brown; stigmatic papillae simple, c. 0.03 mm long. *Seed* ovoid, 0.4-0.6 mm long; testa smooth, stramineous.

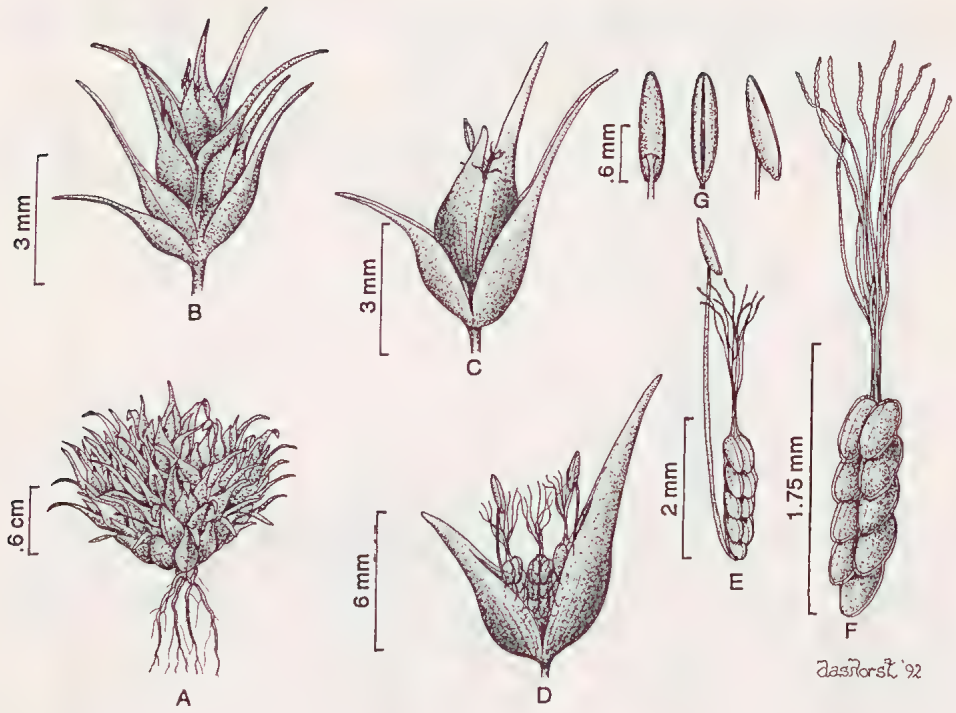


Fig. 20. *Centrolepis cephaloformis* subsp. *cephaloformis*. A, habit; B, branch; C, head with leaf and cataphyll; D, head, opened; E, pseudanthium; F, gynoecium; G, anther, 3 views. (Based on *D. Blackburn BI 55*: AD).

Key to subspecies

All or most heads containing three pseudanthia, two bisexual and the third lacking the stamen; cataphyll obtuse. ..... 19a. subsp. *cephaloformis*

All or most heads containing a single bisexual pseudanthium; cataphyll acute..... 19b. subsp. *murrayi*

19a. subsp. **cephaloformis.**

Laminae of leaves and outer primary bracts manifestly recurved, subequal to the sheath in each case. *Cataphyll* obtuse, veinless, never bearing a lamina. *Head* containing 3 pseudanthia, 2 bisexual and the third lacking the stamen (rarely one of the bisexual pseudanthia absent in reduced heads). Fig. 20.

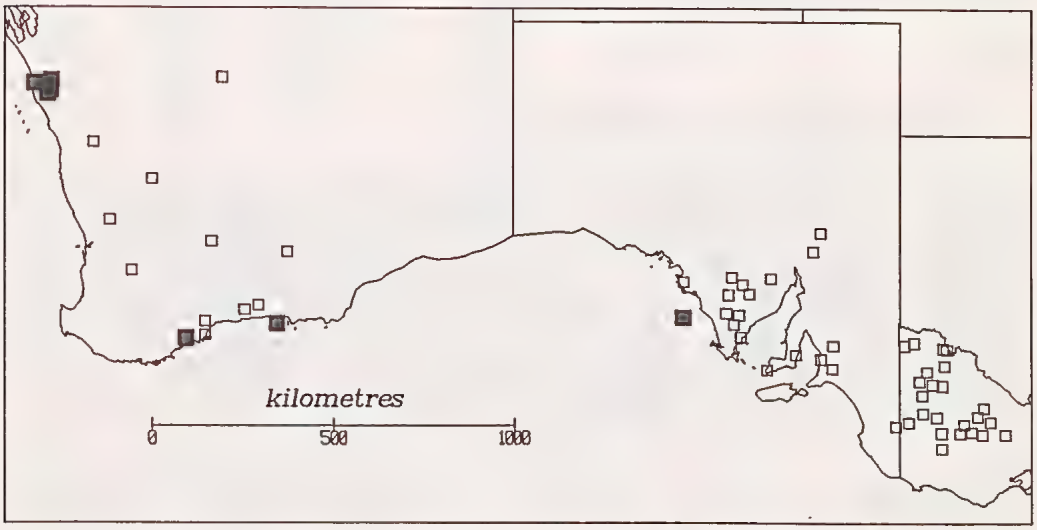
Distribution (Map 19)

Western Australia: scattered in the Darling, Avon, Irwin and Eyre botanical districts of the south-west. *South Australia*: widespread on Eyre Peninsula, Yorke Peninsula and the Murray Mallee; more localised in the Mt Lofty and southern Flinders Ranges and the lower south-east. *Victoria*: widespread west of Bendigo, extending from Hattah Lakes south to the northern Grampians.

Ecology

A winter annual of seral communities with sparse vegetation cover, often subject to water stress or low fertility, such as dunes and the margins of clay pans and salt marshes.

Flowers in September to October. The whole fruiting plant may become detached from the dry substrate in summer and be dispersed as a burr on the fur of animals; the rigid, recurved leaves and bracts appear to be an adaptation for dispersal. It is unusual among the scapeless *Centrolepis* in its relatively ruderal strategy with high seed production (Table 1.)



Map 19. Distribution of *Centrolepis cephaloformis* subsp. *cephaloformis* and subsp. *murrayi*.

see text

Selected specimens examined (total 61)

WESTERN AUSTRALIA: Dundas Rocks, 18.ix.1965, *Beauglehole 13125* (MEL); Martin Creek, 7.ix.1971, *Eichler 21077B* (AD); Oldfield River crossing, Eyre Hwy, 10.ix.1971, *Eichler 21176* (AD); Split Rocks 95 km SSE of Southern Cross, 6.x.1981, *Newbey 9262* (PERTH).

SOUTH AUSTRALIA: Oak Amphitheatre, Hincks N.P., 6.x.1968, *Alcock 2258* (AD); Granite Hill, 33°10'S 136°10'E, 28.viii.1983, *Bates 3227* (AD); Torrens Island, 1.xii.1984, *Blackburn B155* (AD); South Corunna Hill, 8.ix.1974, *Chinnock 2024* (AD); Mt St. John, Wilpena, 15.ix.1978, *Symon s.n.* (AD).

VICTORIA: Little Desert National Park, 3.xi.1978, *Cooke 228* (MEL); Ironstone Hill, 3 miles N of Bendigo, 3.x.1952, *Melville 1393A* (MEL); 2 km NW of Wonga Hut, Wyperfeld, 5.ix.1978, *Muir 5895* (MEL); 8 miles S of Hattah, x.1968, *Noy-Meir 1959* (CANB).

19b. subsp. **murrayi** (J. Black) D. Cooke, Muelleria 4:269 (1980); Fl. S. Aust. 4:1826 (1986).

Centrolepis murrayi J. Black, Trans. R. Soc. S. Aust. 47:367-368 (1923), basionym; Fl. S. Aust. 1:179 (1943); Jessop, Fl. S. Aust. 1:315 (1978).

Type: Hill 781, North Pearson Island, South Australia, i.1923, *T.G. Osborn s.n.* (Holo.: AD 96012011!; iso.: AD 97918146, pro parte!).

Laminae of leaves and outer primary bracts recurved to straight, exceeding the sheath in each case. *Cataphyll* acute, sometimes with a distinct vein and a much-reduced leaf lamina. *Head* containing a single bisexual pseudanthium (very rarely a second pseudanthium present and lacking the stamen).

Distribution (Map 19)

Western Australia: on the west coast near Kalbarri, Beaufort Inlet and in the Recherche Archipelago. *South Australia*: Pearson Islands.

Ecology

Winter annual, *flowering* in August to October.

The habitat of the type collection was stated on the label and by Black (1923) to be *Casuarina* forest, further specified by Osborn (1923) as drainage channels near bare granite slopes; the soil surface was covered by *Ulothrix* filaments, indicating inundation by winter runoff. This *Centrolepis* was not rediscovered during extensive collecting on the Pearson Islands in February 1960 (Specht, 1969) nor among plants germinated from soil samples collected at this time (Symon, 1971). The Western Australian collections are from semi-arid *Banksia - Acacia - Eucalyptus* scrub heath of the Kalbarri system (Beard, 1976) on sandplains near the Murchison River, from saline soil near the Pallinup River mouth, and from soakages around granite boulders on Boxer Island. All habitats have a summer water deficit, with an annual rainfall usually between 300 and 500 mm.

Conservation status

Despite its rarity, a risk code of 3VC is assigned as the populations are widely scattered and represented on reserved offshore islands.

Specimens examined

WESTERN AUSTRALIA: 14.5 km W of Kalbarri turnoff from coast Hwy, 23.viii.1965, *Beauglehole 12063* (MEL); Geraldine mine, Murchison River, 14.viii.1983, *Burns 36* (PERTH); 2 miles [3 km] W of Eurardy Homestead, N of Murchison River, 24.viii.1969, *George 9526* (PERTH); Beaufort Inlet, 1987, *K. Newbey s.n.* (PERTH); Boxer Island, Recherche Archipelago, 8.xi.1950, *Willis s.n.* (MEL; PERTH); 4.5 km N of Kalbarri, 29.ix.1979, *Wilson 2640* (NSW).

SOUTH AUSTRALIA: raised from seed of Type at University of Adelaide, x.1923, *Osborn s.n.* (AD).

20. **Centrolepis caespitosa** D.A. Cooke, Muelleria 4:269-270 (1980); Rye in Marchant et al., Fl. Perth Reg. 2:924 (1987).

Type: Beenup [Byford], W.A., 26.xi.1904, *A. Morrison s.n.* (Holo.: PERTH!).

Small densely tufted annual, softly herbaceous, forming hemispherical cushions to 2.5 cm diam. *Roots* numerous, hardly branched. *Stem* repeatedly branching from the lower axils, forming internodes 0.4-2 mm long. *Leaves* numerous, crowded, glabrous; sheath 0.8-2 mm long, scarious-hyaline, passing into a straight linear terete lamina 5-9 mm long, c. 0.2 mm wide, dark-pigmented in dried material; apex subacute, emucronate. Uppermost leaf reduced to an acute veinless scarious cataphyll 1-2 mm long. *Scape* absent. *Head* terminal on internodes 1-2 mm long, terete, cylindric with a prominent oblique node at the base, c.

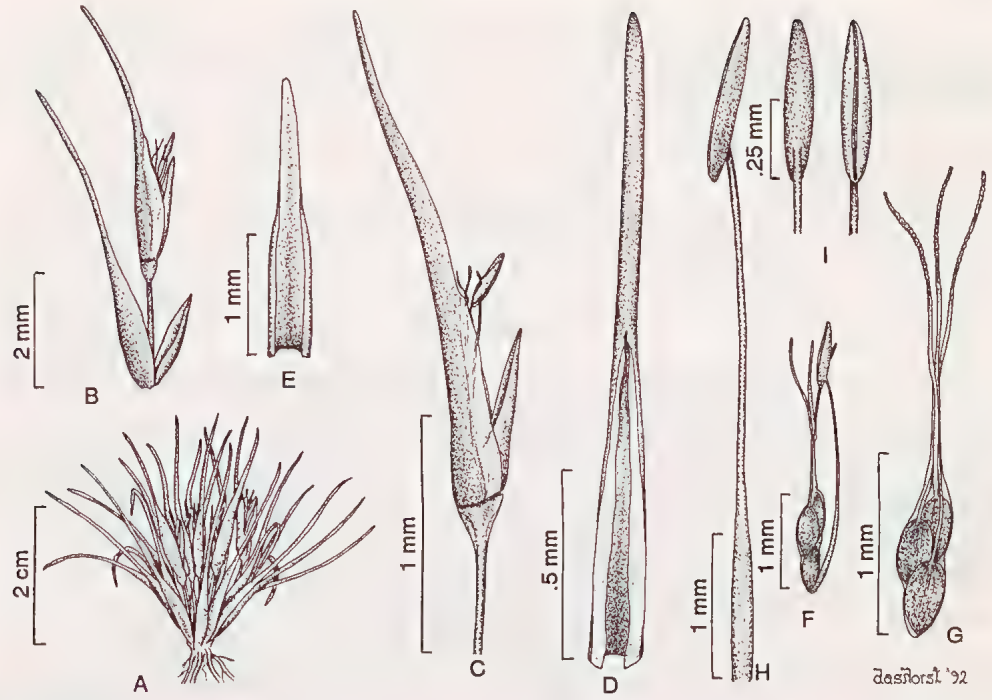


Fig. 21. *Centrolepis caespitosa.* A, habit; B, branch; C, head; D, outer primary bract; E, inner primary bract; F. pseudanthium; G, gynoecium; H, stamen; I, anther, two views. (Based on *G.J. Keighery 917*: PERTH).

0.5 mm wide. *Primary bracts* opposite, glabrous, closely enclosing the head; outer bract with a keel-less 3-veined scarious-hyaline sheath 1.5-3 mm long passing gradually into a leaf-like lamina 2.5-4 mm long; inner bract keeled, 1-veined, 1.5-2 mm long, almost wholly hyaline with a recurved herbaceous apex to 0.6 mm long. *Secondary bracts* absent. Pseudanthium 1, bisexual. *Stamen* free; filament capillary, 3-4 mm long; anther oblong-ellipsoid, 0.5-0.7 mm long. *Gynoecium* of (2)-3-6 carpels; styles 1-2 mm long, connate for one-third to half their length, pale. *Seed* ovoid, c.0.4 mm long; testa smooth, stramineous. Fig. 21.

Distribution (Map 18)

Western Australia: recorded from two disjunct localities in the Perth-Albany region.

Ecology

Has been found on open wet clay soil; both localities are in the 700-900 mm annual rainfall zone. *Flowering* is recorded in November.

Conservation status

Although classed as extinct by Briggs & Leigh (1988), the actual distribution and abundance of this species are uncertain. It is presumed to be rare, and has not yet been collected from any nature reserve.

Notes

C. caespitosa superficially resembles the preceding two scapeless species in habit, but its 3-veined outer primary bract and herbaceous texture suggest that it does not belong in this group of species around *C. polygyna*.

Specimens examined

WESTERN AUSTRALIA: 10 km S of South Stirlings townsite, 10.xi.1976, *Keighery 917* (PERTH); Beenup, 26.xi.1904, *A. Morrison* (PERTH).

Nomen dubium

Centrolepis videns J. Stirling, Trans. & Proc. Bot. Soc. Edinburgh 22:379 (1903), nom. nud.

This species was recorded from the Australian Alps to 4,000' altitude (Stirling, loc. cit.). The etymology of the epithet is obscure, and it may be a misprint for *virens*, evergreen. The same publication lists *C. aristata* and *C. strigosa* for the same region; as the only other *Centrolepis* known from the Victorian Alps is the evergreen perennial *C. fascicularis*, *C. videns* is likely to be a synonym of this species.

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Index to Scientific Names

Names

New names and combinations are in **bold**. Synonyms, misapplied, misspelt, illegitimate or invalid names are in *italics*.

Page numbers

Page numbers in **bold** refer to the main taxonomic treatment. Page numbers asterisked refer to figures and maps.